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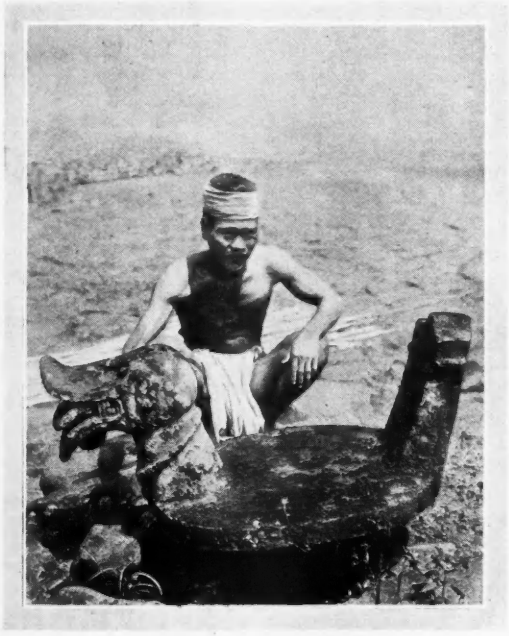
A Monthly Popular Journal of Knowledge

Vol. X. No. 110. FEBRUARY, 1929. PRICE 1s. NET



NATIVE SCULPTURE IN NEW GUINEA
(See page 55.)

CHIEF CONTENTS.

	Pages
Editorial Notes	35
The Future of Wireless	37
High-Speed Flight...	40
Ancient Ruins of Rhodesia ...	45
Correspondence	49
Origin of the War...	50
On Civilization's Fringes ...	55
Among the Stars	58
The Franklin Institute	59
Anglo-American Relations ...	63
Hunting in China	64
Book Reviews	66

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GIVING THE EAST END BOY A CHANCE IN LIFE

ONE OF THE HOSTEL BOYS

"It would, I am sure, be difficult to exaggerate the importance of providing a working lads' hostel in East London; it is hopeless to expect boys to make a real effort to lead industrious lives if they are living with parents who are loafers and drunkards."—Mr. Clarke Hall, the Magistrate at Old Street Police Court.

AMID the dreary labyrinth of streets and the sullen masses of bricks and mortar that are collectively designated "Stepney," there is now to be found an oasis offering comfort, help, and pleasant surroundings to those who, in the very early stages of life's battle, have found the odds against them. This oasis is represented by an imposing and extensive building in Bower Street, which is the scene of the beneficent activities of the John Benn Hostel and Milner Hall. Opened by the Prince of Wales a year ago, these two institutions have already fully justified their claim to public support and recognition, and have demonstrated in the clearest possible way how necessary and how urgent was the establishment of some such centre in the district. Since the days when Dickens wrote of that "reservoir of dirt, drunkenness, and drabs, thieves, oysters, baked potatoes, and pickled salmon," there has, of course, been a vast improvement in the lot of those who live in the East End of London, but in some of its sombre by-ways and alleys still stalk the spectres of evil; there are homes, sadly misnamed, where the young idea is trained in idleness, or worse, encouraged in vice, perhaps crime; there are places where drunkenness, want, destitution, and despair go hand in hand. To do something towards meeting the problem of the East End boy during his years of adolescence, the most impressionable years of his life, is the *raison d'etre* of the John Benn Hostel, which was founded in memory of the late Sir John Williams Benn. It is there to befriend the friendless boy; to give him food and clothes when he is in dire need of them; to find an occupation for him if he lacks work—in a word to give him at least a reasonable chance of becoming a good and self-respecting citizen instead of a ne'er-do-well.

How far, in the short period of its existence, has the Hostel met the demands that it was called into being to satisfy? Visit the Hostel any day, but particularly of an evening when most of the boys, after their work, are at "home" and your impressions will produce an unmistakable answer to the question. To see the sixty or seventy boys who live in the Hostel at supper together, to hear the merry sound of their shouts, laughter and talk, is an experience to touch the heart and imagination of any man or woman who bears in mind that this happy, healthy-looking group of youngsters has, for the most part, been formed of juvenile "down-and-outs." It is the raw material of humanity redeemed from the slough of despond; being slowly but surely in most cases moulded into a better mental, moral and physical outline. Think for a moment of the potentiality of all this plastic material. Remember that it is pulsing with the life of our common humanity. Consider its import to the country and to the Empire.

Empire Builders! Strange as it may seem to those who have not been victims of the "tumbling-up" process, these boys, collected from cheerless streets and many places queer and undesirable, are not oblivious of the Empire. The world really means something to them; it embodies an ideal for them. Pass along the corridors on the top floor and note the neat labels on the doors—Cromwell, Nelson, Gordon, Scott, Wren, and Livingstone. These, it may astonish you to learn, are the names the boys chose—chose on their own initiative without prompting on the part of the Hostel staff—for their dormitories. They wish to be reminded daily of the example set by some of our great builders of Empire. No less than the public school boy are these boys hero-worshippers. Perhaps one—maybe more than one—is destined to write his name large across the history of the British Empire. Who knows?

Something yet remains to be written, so far as the limit of this appeal allows, of the Milner Hall, which commemorates the late Viscount Milner. The Hall may be described as the complement of the Hostel, and comprises two large floors in the same building. In the nature of what is known in America as a "Community Centre," it is designed to focus the social life of the people—men, women and children—of the district. A scheme is in progress for the formation of both girls' and boys' clubs (open to non-residents), and for the benefit of the people generally, community concerts, lantern and other lectures, debates, and similar activities. This side of the work, like the other section, holds possibilities of great development, but from its very nature, it cannot be expected to become self-supporting, and it is estimated that an annual income of £2,000 is necessary. The organizers, therefore, are bound to rely upon the generosity of a philanthropic public. The East End Hostels Association, registered in 1926 to found a series of Hostels in East London, began its work with these two institutions. The general membership of the association—of which Sir Ernest Benn is president of the council of management; and the Rt. Hon. Reginald McKenna honorary treasurer—is open to anyone subscribing 10s. annually or £5 in a lump sum. Cheques should be sent to the honorary secretary, at Bower St., Commercial Rd., London, E.1.

EAST END HOSTELS ASSOCIATION

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Vol. X. No. 110. FEBRUARY, 1929. **PRICE 1s. NET**

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Edited by John A. Benn.

Publishers: Benn Brothers, Ltd. All communications respecting editorial matters to be addressed to the Editor; all questions of advertisements and subscriptions to the Manager.

Offices: Bouverie House, Fleet Street, London, E.C.4.

Telephone: City 0244 (10 lines).

Telegrams: Benbrolish Fleet.

Annual Subscription, 12*s.* 6*d.* post free anywhere in the world. Single numbers, 1*s.* net; Single back numbers more than two years old, 1*s.* 6*d.* net; postage 2*d.*

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Editorial Notes.

For some weeks past the activities of the British Broadcasting Corporation have been the subject of considerable discussion by reason of its new venture in publishing another weekly journal entitled *The Listener*. As we write, a settlement has just been made with the representatives of the press, by which the contents will be confined almost entirely to the printing of broadcast talks. In our present issue, writing on "The Future of Wireless Broadcasting," Sir John Reith gives the public an inside view of progress in the main activity of the B.B.C., which has been going on quietly but not unnaturally tends to be overlooked. From the plans outlined in the Director-General's article, it becomes clear that the energies of those in control of the Corporation are still chiefly occupied with the production of an adequate broadcasting service. The engineering problems involved in ensuring that programmes shall be available to the whole population are only now nearing an adequate solution. The difficulties have not been made easier by the fact that the wave-bands available in Europe are greatly over-crowded, and it is satisfactory to learn that owing mainly to the initiative of the B.B.C., international arrangements are again on foot to produce order out of chaos. That there is need for improvement in many directions Sir John Reith would be the last to deny, for, as he says, the main characteristic of the broadcasting service is still a restless enterprise. No doubt criticism has been justified on certain matters, but we hope that our publication this month will do something to inspire gratitude where gratitude is obviously due.

* * * * *

A scheme for a Channel Tunnel is again in the public eye, following the publication of a book by Mr. William Collard. The proposal to link England and France in this way originated more than fifty years ago, at a time when the problems of engineering presented overwhelming obstacles. As at present, a chief difficulty was ventilation, of which those who can recall passing through the Blackwall Tunnel in its earlier days will have had vivid indications. So far as providing a railway tunnel is concerned, the construction would now be fairly straightforward, but whether the new idea is feasible of a motor roadway as well is open to question. Even to-day it seems certain that the most efficient devices could not make tolerable a twenty-mile journey by car underground. As in 1924, however, when the project was considered by the Committee of Imperial Defence, the chief obstacles to its approval are defensive considerations. Undoubtedly also the psychological factor that England would be no longer an island has still to be reckoned with. In the case of war it should not be difficult to explode or flood a tunnel at a few moments' notice, but meanwhile the alternative sea routes would have lapsed into serious disuse. It is not generally realized how great is the extent of the small shipping on which our channel trade and communication at present depends.

* * * * *

In this issue Mr. Campbell-Swinton replies to the criticisms that have been made in these columns, following his recent article on television. Undoubtedly there is general agreement in scientific circles with his view—which we share—that efforts to perfect television on present lines have definite limitations, but this does not alter our conviction that an exaggerated comparison has crept into his argument. In endeavouring to discuss in simple terms what is ultimately a highly technical matter, there is always the danger that confusion may arise, and it is possible

*

that we have not fully grasped Mr. Campbell-Swinton's contention. His latest letter again objects to our distinction between television and photography—which was supported by Dr. Pullin—and says that it presumes "a kind of mental process on the part of the apparatus to distinguish between essential and non-essential details which would be almost human, and which no mere mechanism can be expected to carry out." Our contention, however, is not that the television machine has any human attributes, but only that as its purpose is distinct from that of the camera, strict comparison of the two is invalid.

* * * * *

The seventh season of excavations at Ur in Mesopotamia has opened with some interesting discoveries, according to a first report which Mr. Leonard Woolley has sent to *The Times*. Further diggings have given rise to a new theory as to the ritual of royal funerals, following the finds last year of many rich tombs. The appearance of votive offerings buried at successive depths in a shaft of vertical character suggests that, after burial had been made and the earth thrown back above the bodies, then at intervals the offerings were laid in with the earth. At a certain stage the filling in of the shaft would be stopped, and a chamber constructed in it to receive the last offerings. Then more earth would be poured in and perhaps a superstructure in the form of a funerary chapel would complete the whole. Whether the new excavations will substantiate this theory is one of the most important problems of the season. Among other new discoveries has been found an ancient harp in a remarkable state of preservation. The woodwork of the frame had all perished, but luckily a workman noticed in good time the holes left by it in the soil, and by filling these with plaster of Paris, Mr. Woolley obtained a complete cast of the harp's body, to which was attached a bull's head of copper inlaid with lapis lazuli. The most astonishing discovery was that when the earth was carefully cut away to expose the cast, there were found yet surviving as lines of white fibrous powder the ten catgut strings.

* * * * *

The date has now been fixed by the Royal Aero Club for this year's contest for the Schneider Cup, which will be competed for over the waters of the Solent on 6th and 7th September next. The last previous race was held in 1927, since when Italy has secured the world's record speed of over 318 miles per hour. British aviators have now just beaten this achievement, but not with sufficient margin to constitute a new record. While the desire to win the Schneider Cup has a national interest in which most people share, the question not unnaturally arises as to whether speed attempts have enough value to justify the tremendous risk to life involved. We therefore invited Major Turner, who has for so long been associated with aeronautical science, to write an answer to the question, and this we publish on another page. Not the least interesting of his remarks is that no machine is nowadays designed to fly at the minimum speed of about twenty miles an hour, below which flight cannot be maintained. The modern tendency is undoubtedly towards faster speeds for all classes of aeroplane. Those, however, who fear that as time goes on they will only be provided with machines of "break-neck" tendencies can take comfort so far as Britain is concerned, for Major Turner shows that flying at 300 m.p.h. requires a visibility of at least ten miles ahead. This circumstance appears to rule out the use of such craft not only here but in many other countries as well.

* * * * *

As illustrating the parallel progress in commercial flying, it will soon be possible to reach India in six days from London. Preparations are now almost complete for the opening in April by Imperial Airways of the great 5,000 miles Empire air route. The journey will be made in six daily stages. Passengers and mails leaving London on the morning of the first day on a large air liner will fly to Basle in Switzerland. Here they will take a train under the Alps to Genoa, where on the second morning they will embark on one of the new all-metal flying boats to cross the Mediterranean to Cairo, a flight which will take two days. The flight across the desert from Cairo to Basra via Baghdad will be made on the fourth day, while the flight down the Persian Gulf to Karachi in India will occupy the remaining two days. Arrangements are being made to continue the Empire air route across India to Calcutta and thence via Singapore to Australia, while a branch line to Cape Town will connect with the main route at Cairo. A number of new pilots have been engaged in readiness and are now undergoing training in flying the giant air liners on the London-Continental lines.

* * * * *

Further articles in our "Next Step" series will include, besides those already announced, a contribution from Sir Oliver Lodge on pure physics. Remarkable changes have lately taken place in basic conceptions, but while much has been written about applied physics, such as in wireless and television, the theoretical aspect has been little discussed. Sir Oliver's views will therefore be keenly appreciated.

The "Next Step."—II.

The Future of Wireless Broadcasting.

By Sir J. C. W. Reith.

Director-General of the British Broadcasting Corporation.

The giant growth which the science of wireless has experienced in five short years has been so phenomenal that to-day nearly three hundred stations in Europe are trying to broadcast on a wave band barely sufficient for a hundred. This is one problem of which Sir John Reith discusses what solution the future may bring.

ONE might well begin a discussion of this kind by emphasizing the truism that the first problem of a public service organization is to confer its service as soon as possible in equal measure upon all the people of the country. This consideration has been paramount in the policy of British broadcasting from the beginning. It was necessary, of course, to move in stages. The first objective, modest enough in the light of achievement, was received with scepticism. It was not long, however, before those who happened to find themselves outside the service area of one of the five original stations were complaining that their rights as citizens were ignored. Four more stations were added in important industrial centres, and still the demand increased. Each station was encouraged to reflect local talent and culture. Civic pride and emulation soon manifested themselves. Yet even in those days it was not practicable to continue indefinitely to add stations even of the modest power of the first eight. Available ether channels were limited, and the point of interference was easily reached. So eleven relay stations of small power were built in the areas of dense population not yet served. The task of these stations was not to originate but to make the London programmes available to hundreds of thousands of the industrial population on the cheapest and simplest apparatus.

Problems of Distribution.

Having made at least one programme accessible to nearly the whole of the urban population of the United Kingdom, the B.B.C. then turned its attention to the countryside. The permanent high power station at Daventry (5 XX) was added to the system. Thereafter a minimum of one programme was available to 80 per cent of the population of Great Britain. This had been accomplished in just over two years.

Pursuing its basic policy, the B.B.C. had next to consider whether it was possible to reach the remaining 20 per cent of the population with a single programme, and simultaneously how to develop alternative programmes. If the problem of distribution could have been considered without regard to the requirements of other countries these further objectives would not have been difficult of attainment. The single wave-length transmitters at all stations might have been converted into twin wave-length transmitters thereby giving to all listeners in service areas the minimum choice of two programmes. In order to reach that part of the population still outside service areas, the power of some main stations might have been increased, and even more relay stations added to the system. Unfortunately, no such logical simple solution was possible. While the British system of broadcasting was emerging, new stations were springing up all over Europe at an alarming rate.

Order from Chaos.

The band of frequencies available for broadcasting by international agreement allowed for not more than 100 stations to operate without interference. As early as 1925 this number was exceeded and the increase accelerated. As the number of Continental stations became excessive for the wave-band, the uninterrupted range of B.B.C. stations began to decrease. Owing mainly to the initiative of the B.B.C., the Union Internationale de Radiophonie was created to try to reduce order out of chaos. In due course a scheme was evolved (known as the Plan de Genève), by which the frequencies—exclusive and non-exclusive—were distributed in as fair a manner as possible. Great Britain was allotted ten exclusive frequencies on which to operate twenty-one stations. This plan might have been permanently successful if the increase in the number of stations on the Continent had been checked. But the number of transmitters continued to grow while the terms of the plan itself were not scrupulously applied in every case. Conditions therefore tended to become steadily worse.

Accordingly to-day there are no fewer than 270 stations in Europe trying to operate on a wave-band just sufficient for 100. The result is that so-called exclusive frequencies are progressively impaired and the international common frequencies are practically

useless. Where the nine main stations of the B.B.C. two years ago had an uninterrupted range of twenty miles for reception on simple apparatus and the relay stations five miles, these ranges have now been reduced by interference to five and one and a half respectively.

The Regional Scheme.

It is only fair to state that the B.B.C. were aware three years ago of the dangers of the situation. It was then that a plan for the re-distribution of broadcasting in Great Britain was evolved. This plan has since come to be known as the Regional Scheme. It took into account the limitations imposed by the international situation. Its principle was to substitute fewer stations of higher power for the comparatively numerous low powered stations of the existing scheme. The five new stations would have a power of the order of thirty times that of the eight main stations. It was proposed that each of the new stations would be built to accommodate two transmitters capable of operating on different frequencies and transmitting separate programmes. This scheme combined making the best of a difficult engineering situation with an attempt to solve the problem of alternative programmes. Had it been possible to proceed with the Regional Scheme two years ago it would have been nearing completion by now, and British listeners would have been assured of reasonable immunity from interference. But various obstacles imposed delay. For one thing the future constitution of the broadcasting service was uncertain, Lord Crawford's Committee not having reported. For another thing, the Postmaster-General as " policeman of the ether " had difficulty in adjusting rival claims and also some misgiving about the possible effect of such a drastic change in distribution

Not until 1927 was permission given for the erection and operation of the experimental high power medium wave transmitter at Daventry (5 GB). It was desired to collect data on the operation of a transmitter of this power and on the extent to which interference with other essential wireless services was likely to result. Advantage was taken of the opportunity of experiment in contrast programmes. The results of the working of the Daventry experimental station have been eminently satisfactory. Justified by these results, permission was given last summer for the construction of the first of the new permanent high power regional transmitters. This is now being built at Brookman's Park, near London, and it will be in operation by the early autumn of this year. In the initial experimental period the new London station will transmit one programme only, and a limited alternative will be provided by Daventry (5 GB). Preliminary steps have been taken in connexion with the new high power stations for the north of England and for Scotland. It will not be long before the station for Wales and the west of England is dealt with. While, of course, a great deal depends on the experience gained in the construction of the new London station, it may be predicted with a measure of confidence that the north of England and Scotland will be served by their new stations early in 1930; Wales and the west of England, before the end of 1930.

Meanwhile, an increasingly difficult period of transition has to be faced. The international situation tends to become worse rather than better. It is true that there is to be a fresh convention for European broadcasters, and a new plan will be put into operation early in this year. But the B.B.C. is not content to rely solely upon the possible effect of this new plan. The position of relay stations is so serious that other remedial action is imperative. For some time past the relay stations have been working on international common frequencies. Service in Britain on these

BRITISH BROADCASTING STATIONS, 1929.

frequencies is nearly valueless and, if the position could not be improved, then there would be no reasonable alternative to closing down all the relay stations. But the policy of the B.B.C. is naturally to avoid depriving listeners of any service unless and until a reasonable substitute is available. If the Regional Scheme were in existence, it might have been possible to dispense with the relay stations now; but this scheme is still a long way from completion.

As a temporary measure, until the Regional Scheme is ready, it has been decided to abandon the use of several international common waves and to introduce apparatus which will enable all British relay stations to operate on a common national exclusive frequency. This is an engineering task of considerable difficulty involving the exploration of new ground; but recent quantitative experiments provide substantial hope that, as a temporary measure, this single wave-length working will materially improve the service of relay stations.

The position may be analysed as follows: If two stations operate on a single frequency, the condition for satisfactory reception from one is that the strength of signal from that one must be 200 to 300 times that of the other or others sharing the wave-length. Now, if these two stations sharing the same wave-length transmit the same programme, then for satisfactory service the strength of one must be five times (not 200 times as with different programmes) that of the other stations sharing that wave-length. The interference from distant stations increases after sunset, and so the service range of a station sharing a wave-length decreases after dark. It is better, therefore, that all stations working on a single wave-length should always transmit the same programme, but after dark it is essential that they do so. During daylight, stations relatively close to one another must transmit the same programme. Thus, in applying single wave-length working to relay stations, the B.B.C. has been forced to reduce the proportion of local programme contribution after nightfall. As much as possible of the local element is being retained. For instance, in view of the increased possibility of group transmission by daylight, items such as the Children's Hour will originate and be distributed regionally during the summer. The actual grouping of relay stations under the new arrangement is as follows:—

Scottish	..	Dundee and Edinburgh.
Northern	..	Liverpool, Stoke, Leeds, Bradford, Hull, Sheffield.
Welsh	..	Swansea.
South-West	..	Plymouth.
South	..	Bournemouth.

The rate of development of the programme service is necessarily governed by the rate of engineering progress. The approach of the era of alternative programmes is duly allowed for. On all sides of programme activity, particularly in research, steady progress is being made. Next autumn should see the inaugural season of the new National Symphony Orchestra of at least one hundred musicians established on a permanent basis. Meanwhile, work on the new headquarters building in London (Portland Place) will be pressed forward. It is gratifying to observe that the main characteristic of the broadcasting service is still a restless, unsatisfiable enterprise animated by deep consciousness of public responsibility.

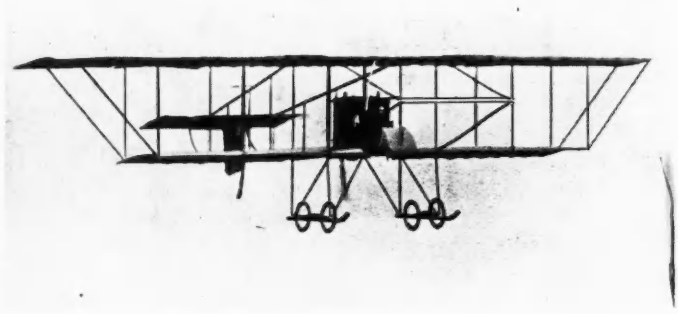
PROPOSED NEW HEADQUARTERS FOR THE B.B.C.

New Records in High-Speed Flight ?

By Major C. C. Turner, A.F.R.Ae.S.

Further attempts at a flying speed record are to be made this spring by British pilots, who in rivalry with the Italians already lead the world. An Italian seaplane holding the present record of 318½ m.p.h. has been beaten by a margin too small to comply with official requirements for a new record. As these are specialized and not utility craft, the question arises—Why, at great cost and risk, are still greater speeds to be attempted?

In a perfect world, perhaps, scientific development would need no assistance from sport or from individual or national rivalry. Research and its practical application, richly endowed, would march along the appointed paths: haste demanding risk to life would be abhorred. A perfect world would, some think, be less interesting and might not, after all, offer the same incentives to progress. The story of flight is a story of progressive achievement, and to that achievement a spur has from the first been prizes, the demands of war, and the upholding of national prestige, in part sentimental, but having commercial reactions. International rivalry, individual rivalry, even individual vanity, and sport, are playing in these affairs an important and necessary part.



HOWARD WRIGHT BIPLANE (SPAN 40 FEET).

The original Wright aeroplane maintained practically the minimum theoretical speed of flight, about 19 or 20 m.p.h. No machine since built has equalled this low speed—about half the minimum speed of slow machines of to-day.

The present situation is one of extraordinary interest, and it can only be understood in the light of aeronautical technical history. Twenty-five years ago, when the first flight on a motor-driven aeroplane was made, the question of speed was unimportant beyond the consideration that it was necessary to attain sufficient speed to enable the wings of the aeroplane to obtain lift by the reaction from the resistance of the air afforded by their shape. It is interesting to consider the fact that on the original Wright aeroplane horizontal flight was maintained at practically the minimum theoretical speed of flight, about 19 or 20 m.p.h. No machine since built has equalled this low speed, but any aeroplane designer to-day could—and I wish one would—design an aeroplane which would be able to fly even at less speed. Six years after the first flight a low-speed flying competition was won by a Wright aeroplane.

Between 1903 and 1908 the sole object of experimenters was that of achieving flight. Success lay in getting a machine to leave the ground under its own power and to remain in controlled flight for a measurable period. In 1909 a speed of 60 m.p.h. was attained by a single-seater with an engine of 50 h.p. To-day a single-seater of 50 h.p. can be made to fly at nearly 200 m.p.h., and, moreover, fly very much better.

When the first flight was made it was already established that resistance varies as the square of the velocity. That is to say, if the speed be increased 300 per cent the resistance increases 900 per cent. And this is a law which has made the attainment of increased speed extremely difficult and, as we shall see, extravagant of power. But it has also led to research and experiment with resistance-reducing bodies. A circular flat plate forced through the air encounters a measurable resistance. A sphere of the same cross-section area encounters less resistance. In each case, by doubling the speed four times the resistance is encountered, or, by trebling it, nine times the resistance. The advantage of adopting a form which offers less resistance than the flat plate, and if possible less resistance than the sphere, is obvious, and clearly the greater the speed the greater the advantage.

Experiment shows the actual resistance of any particular form at any particular speed in a specified density of air; and once the actual pressure is

measured it is possible to calculate the resistance for different speeds and different sizes of the same form. Resistance, or "drag," is made up of the actual frontal opposition, of back-suction due to eddies at the rear of the object, and of "skin friction" due to the flow of air over the surface. A low-resistance form is one over which the air flows evenly at all parts, closing in at the rear without setting up eddies or the areas of diminished pressure which cause suction. At low speeds none of these retarding effects are serious, but as the speed is increased they all increase, and at very high speeds even the item of skin friction becomes important. The form which offers least resistance is known as "streamline," somewhat egg-shaped, with the blunter end foremost, for the greater speeds a somewhat slender egg form, and for low speeds a chubby egg. Experiment in the wind tunnel determines the best form at different speeds.

RADIAL-ENGINED BRISTOL "FIGHTER" (31 FEET).

The Schneider Cup contest led to a valuable attempt to exploit the utmost possible speed qualities of the "Fighter" class, which can now travel at 180 m.p.h.—this speed seems to make the limit demand upon the human factor.

In aeroplane practice the most striking proof is afforded by the great difference which an increase of from 50 to 100 h.p. made in the early days of flying, when speeds did not exceed 120 m.p.h. Then 100 per cent increase of power secured nearly 100 per cent increase of speed. But in the 200 to 300 m.p.h. range of speeds an addition of 50 h.p. brings an actual increase of speed of no more than 12 or 14 m.p.h., or a percentage increase of only about 5 per cent. A case in point was afforded by the Schneider Cup contest of 1926, when 880 h.p. was employed in an Italian seaplane to obtain a speed of 258 m.p.h., as against 600 h.p. used in an American machine the previous year for a speed of 246 m.p.h., showing that it needed 280 extra h.p. to give an increase of 12 m.p.h.! Of course, there were differences in the design of the aeroplanes, but both were single-seaters, and both had been designed for the highest possible speed.

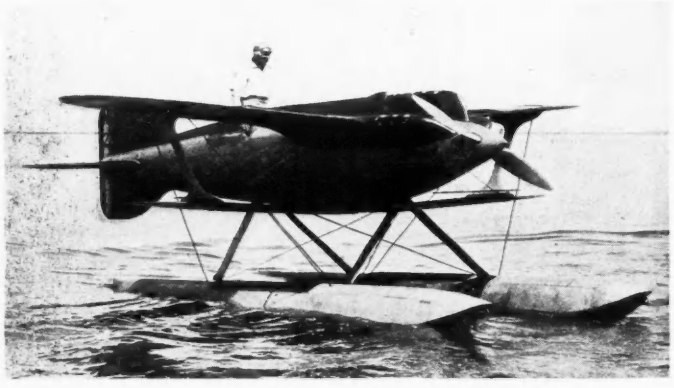
Under the inducement of races and records aeroplane designers and engine makers have co-operated in work which may be expressed by the following points:—(1) Increase of power without increase of engine weight. (2) Reduction of weight for the same power. (3) Increase of power without increase in the resistance-area of the engine. (4) Reduction of resistance-area for the same power. (5) Avoidance in the aeroplane structure of resistance-creating forms and arrangements. This has involved a vast amount of research and experiment relating to shape of struts and wires, the shape of the body of the machine, interference between the wings (in a biplane), interference at the attachment of wings to body, shape of landing carriage, and floats. (6) Increase of propeller efficiency (a vast subject). (7) Increase of maximum without increase of minimum speed beyond the landing safety-limit. This has involved much research in wing-forms. It also has important reactions on the development of the flying art.

Many subsidiary points are mentioned in the course of this article. But in every one of these details the effort to attain greater speed has secured definite advance, and in nearly every case this advance has proved beneficial to the whole range of flying, some of them, moreover, having reactions to other spheres than that of flying.

Many of these details are determined by laboratory experiment, at any rate in the initial stages, although a great deal has to be left to actual flying tests. For example, it was very soon found that scale-effect was an unknown quantity. Experiments with models in the artificial conditions of the wind-tunnel only determined approximately the performance of full-scale machines and the resistance of parts of machines. Further, there was the drawback that the speeds of the artificially-created wind in a laboratory fell far short of the speeds attempted in real flight, so that although aerodynamical laws were being ascertained and formulated they could only be proved by actual experiment in the air and at the speeds desired. The discrepancies have been steadily reduced, however, and it is now possible to predict far more accurately the performance of machines and the reactions of parts of machines. Wind-tunnel speeds for long did not exceed 80 m.p.h. By the use of compressed air,

however, something approximating to 250 m.p.h. can now be obtained. But there remain many artificialities and unsatisfactory conditions. Discrepancies are still discovered, and clearly the smallest fractional error in a model experiment may prove formidable in full-scale.

Neither the land aeroplane nor the seaplane is a one-element craft. The land aeroplane must gather speed for flight on the ground, and must land on the ground. The seaplane must gather speed in the water, and must alight on the water. The complete structure in each case is a compromise, and to arrive at the most efficient compromise actual experiment in full-scale must be made. In this work a large number of associated sciences and arts come into practice. For example, in the construction of floats for seaplanes an enormous amount of research and experiment has been accomplished. There was no precedent in this branch of the work, and for the last twenty years the design and construction of seaplane floats has been developing. Thus, granted the need for testing the utmost possible aircraft speed, it was necessary to design floats which would stand up to a water-speed approaching 100 m.p.h., and bear the shock of alighting at that speed. At the same time, when in the air it was necessary that they should offer the least possible air-resistance and not disturb balance.



GLOSTER-NAPIER N.
This machine won the Schneider Cup for Britain in the last previous race held in 1927. It is a biplane with a wing-span of 22½ feet.

For realization of the highest possible speed almost everything had to be sacrificed to it. The fuselage, which carries the engine, pilot, and tail piece, had to be reduced to the least possible girth. That girth was determined by the size of a human body and by the size of the engine; and the mechanical item—the engine—was gradually, as the result of costly development, reduced to the human item, so that to-day the engine and the pilot can be brought into one "streamline" case. A good example of this is seen in the development of the Napier racing engine. For the Schneider races this engine, the "Lion," has been modified in various ways. The carburettor, which formerly necessitated a wide, broad-arrow setting of the cylinders, has been tucked away, and the arrow has become narrower. Still the ends of the cylinders projected considerably beyond the streamline fuselage, which otherwise fitted close to the pilot's body. It was, however, found possible to inset the cylinders deeper into the crankcase, this effecting a great reduction in resistance. Weight-reduction continued with the aid of metallurgical research and by mechanical improvements, and at the same time the compression-ratio was increased giving more power, so that what had been a 450 h.p. engine gradually developed to an 880 h.p. engine, actually weighing less. Incidentally, in the process the standard "Lion" engine for general use in the R.A.F. and on the air lines increased from 450 to about 530 h.p., with other advantages.

But that is not all. The tremendous speed of the improved racing engine rotated the airscrew too rapidly for the best efficiency of that extremely difficult part of the machine. The matter would be simple if a different airscrew could be used in taking-off from that used in high-speed flight, and it would be easy if the diameter of the airscrew had not to be adapted to a craft which has to "taxy" along the land or the water. In short, it was necessary to devise a reduction gear which would be light, and at the same time would not fail at the tremendous rotational speed of the engine. Reduction gears are in common use in aircraft, but until 1927 they had not been applied to a very high-speed engine. A reduction gear was devised, and it had to be tried, many foretelling failure. However, it stood the test, and the British machine won the Schneider Cup. This was a mechanical advance of the greatest importance and with a great future.

So far I have referred only to one type of engine, a type with the cylinders in three lines, this type offering less resistance than that with the cylinders attached radially and looking from the front rather like a chrysanthemum. Nevertheless, it is the radial

type of engine which is commonly used in the high-speed "Fighter," despite the disadvantages of its great air-resistance. It is air-cooled, and it is compact, the latter quality making it suitable for "stunting" and the former giving a quick take-off without much preparation, whilst the absence of a radiator obviates a frequent source of trouble. The Schneider Contest led to a valuable attempt in 1927 to exploit the utmost possible speed qualities of the radial-engined machine, and the type produced has improved the "Fighter" class.

The speed effort has led to the adoption of wing-radiators, first used in the American machines in 1923, giving them a big advantage, for they avoided the resistance due to external radiators. The corrugations on the surface of the wings, however, made for resistance, and as about 70 per cent of the resistance of a high-speed wing is due to skin-friction, and the corrugations almost doubled the area of the surface, they were not all profit. In 1927, however, wing-radiators with a flat surface were introduced, and despite the fact that the surface had to stand heavy stresses without being unduly heavy they were successful. Thus a new development was brought to success.

THE WORLD'S FASTEST SPEED.

The Supermarine-Napier S 5 machine (22 feet span) in which a British pilot reached the highest speed ever attained (319½ m.p.h.). The officially-recognized record of 318½ m.p.h. is held by Italy.

Now to the light-weight high-power engine, with the improvements already detailed, will be added superchargers, by means of which air will be forced in at more than normal pressure giving still greater fuel-value and greater engine-speed.

About five years ago French and American high-speed aeroplanes were fitted with detachable undercarriages, so that the airman, having left the ground, could jettison the chassis of his machine and attain greatly increased speed. In landing he would "stall" the machine near the ground and drop "pancake-wise," smashing the wings but probably escaping injury himself. In land aeroplane speed contests and record attempts, however, there were many accidents, and since that period the greatest absolute speed over a short distance has been made by seaplanes, by which, it appears, in good conditions safe landings can be made at higher speeds than on land. Nevertheless, it has been suggested that in the near future a seaplane will be fitted with a detachable undercarriage, and the pilot, having dropped the floats and finished his test, will leave the machine and descend by parachute. This extravagant and dangerous experiment will not, it is to be hoped, be attempted, for although it would be interesting to ascertain the speed thus attainable, the price in material and the risk to life would be out of proportion to the result. If, however, the mechanical difficulties in the way of tucking the floats of a racing seaplane close up to the bottom of the wing during flight could be surmounted, it might be worth while.

In another detail the Schneider Cup contest has led to a definite improvement in design. The designer of the Supermarine-Napier S 5, which won the race at Venice, found it difficult to provide room for the fuel tank in the slender fuselage, and he was led to the experiment of placing it in one of the floats. This resulted in an incidental and very important advantage. It was necessary to place the fuel tank in the starboard float, for had it been fitted in the port float its weight would have further aggravated propeller torque, a force which tends to overturn the machine in the opposite direction to the rotation of the airscrew. This, of course, is a characteristic of all single-propeller aircraft, and it is usually allowed for in the design by setting the wing on one side at a slightly greater angle of incidence than the other, thus giving extra lift on that side and neutralizing propeller torque without upsetting control.

By placing the fuel in the starboard float the need for a greater wing angle on one side was obviated. This prevented the slight loss of speed due to that feature. But, further, it secured the very great advantage of improving the take-off, when torque has a hampering effect. It lowered the centre of gravity of the machine, and it permitted a slight reduction in the size of the floats, which with torque corrected in the usual way need a big margin of buoyancy. This

really amounted to a discovery in design, and doubtless it will have applications in other classes of aeroplane.

In speed development the adaptability of the human being to flight conditions has been proved to be far greater than was formerly believed. Indeed, only three years ago it was asserted that no pilot could endure the accelerations and decelerations and turning movements of these highly specialized craft.

Pilots' Ordeals.

Pilots, indeed, went through severe ordeals, and courageously faced the unknown. There were repeated instances of loss of consciousness in the air—" black moments " which may have been the cause of some of the accidents. Despite these conditions, which aroused much controversy at the time of the Schneider contests of 1925 and 1926, the very much greater speeds attained in the race of 1927 were sustained without mishap. Pilots had learned much. They had studied the details and had consulted physicians of the air services, and it was found that by certain precautions in diet before the tests and in flying during them, no ill-effects were suffered. The turns were taken in a different way; and, incidentally, it was found that less time was lost in an even, wide, sweeping turn than in the picturesque, abrupt turning climb and dive favoured at one time. The worst moment is that of acceleration when the machine leaves the water and suddenly speeds up in the air. Apart from this, high-speed pilots enjoy their work.

The speed at which descents can be made to water has increased, partly owing to improvements in the design of the machine and partly due to improvement in the flying art. The maximum speed of flight could be increased considerably if the minimum speed could also with safety be increased; but, as Mr. H. P. Folland has put the matter, " The advantage gained in this direction will depend on the country which is willing to risk higher stalling speeds, and pilots who are willing to take the risk of flying such machines."

Coming to practical applications of high speed, it will be admitted that in air transport, provided they could be secured without risk, the time saved in travel would be important. High speed has to be paid for, no matter what the form of travel may be; but always there are those who are willing to pay for it. Whether it would be possible to fight in the air in machines travelling at more than 200 m.p.h. is open to question, but present-day " Fighters," which do about 180 m.p.h., seem to make the practicable limit demand upon the human factor. One very serious disadvantage of great speed, except in countries blessed with a clear atmosphere, is the vast space they need and the demands upon the pilot's vision. Flying at 300 m.p.h. a pilot needs visibility of at least ten miles for reasonable safety. Thus, circumstances appear definitely to rule out such craft from many regions of the earth, including, needless to say, Great Britain.

In the development of high-speed tests much light has been thrown on the question of " wing-flutter " which is known to have caused a large number of accidents, and has probably been the cause of many otherwise mysterious mishaps. It has led to structural improvements far too numerous to mention. It has brought about improvement in every part of the engine, from the plugs to the crankcase and the cowling, of inestimable value. Thus, at Venice in 1927 the maximum speed of the Napier engine was 3,200 r.p.m., and then, when the question of permissible speed during the dive down on to the speed course was considered, when it was anticipated that a diving speed of nearly 350 m.p.h. would be reached, many foretelling failure, the revolutions went up to 3,950 p.m. without increased vibration or any indication that the limit had been reached.

There are parallel cases of indebtedness to specializing in order that the normal may be improved. Take, for example, motoring. It cannot be doubted that track-racing has " improved the breed," just as horse-racing has improved the breed of horses, although one would not take a Derby winner and put him immediately to any useful work. But on the whole there is sound and abundant reason for continued research and experiment in high-speed flying.

The 1929 Contest.

The Schneider Cup contest, formerly annual, is now biennial, the Fédération Aéronautique Internationale having decided that typal development is slower than it used to be, whilst the cost is increasing. The last contest was in 1927, at Venice. Great Britain won, and as a result the next contest (this year's) will be in British waters. This event will take place at Cowes, on September 6th and 7th, day to day postponements on account of weather being permissible. The course is a triangular one fifty kilometres in length, and the competitors must make seven circuits, the race thus totalling about 218 miles. Preliminary tests are required before the race to prove the final control and sea-worthiness of the machines. Great Britain, Italy, France and the United States have entered this year.

The Ancient Ruins of Rhodesia.

By E. N. Fallaize.

Hon. Sec., Royal Anthropological Institute.

New investigations are already in progress on the Zimbabwe ruins, of which a special report will be made to the British Association during its South African meeting next July. The problem of their origin and date is of first importance to archaeology, but so far remains an unsolved mystery.

To the ancient world, unexplored Africa was a country of mystery and marvel. This atmosphere of wonderland in which nothing was unexpected because everything was possible, to a great extent has vanished before modern transport, though African travel can still be far from prosaic. Yet at least one mystery remains—the ancient ruins of Rhodesia, of which the origin and purpose are still not known. Like the Maya civilization of Central America, these ruins seem to spring spontaneously from the soil with no certain reference to preceding conditions or sure evidence of relation with the outside world.

New Excavations.

It was with this in view that the British Association for the Advancement of Science, in preparation for its visit to South Africa in 1929, asked Miss Gertrude Caton-Thompson to undertake systematic excavation at Great Zimbabwe and any other of the ruins in Rhodesia at which time and opportunity might allow before the date of the meeting of the Association in July. This is not the first occasion on which the Association has contributed to the investigation of the problem. When it first visited South Africa in 1905, it was preceded by Dr. David Randall-MacIver, who excavated at Great Zimbabwe and at six other sites. Although Dr. Randall-MacIver was an experienced archaeologist, trained in the school of Egypt, his conclusions did not commend themselves to all, especially local, archaeologists. Some exploration and still more controversy have followed. It will be Miss Caton-Thompson's endeavour to test and carry further Dr. Randall-MacIver's investigations. A certain piquancy is added to the situation by the entry into the field of a German expedition under Dr. Leo Frobenins. Miss Caton-Thompson will report to the British Association at the South African meeting, but the interest will be heightened if the two explorers stand side by side.

Great Zimbabwe itself is situated about fifteen miles from the township of Victoria in Southern Rhodesia. It is the best known and most important but not the only one of its kind. In fact, the name Zimbabwe is generic, being applied locally to all these ruins as a class. Of uncertain derivation, the name has been said to mean either a "head kraal" or "stone buildings." These ruins exist in numbers which have never yet been fully ascertained; but they have been estimated at over five hundred, and well over two hundred and fifty have been actually recorded. They lie scattered over the area which is roughly between the lower Zambesi and the Limpopo rivers, approximately covering part of Mashonaland and Matabeleland. They stretch over into Portuguese territory down to within seventy miles from the mouth of the Sabi, about sixty miles south of Sofala. Although their exact distribution has still to be plotted, the extension into Portuguese East Africa would look as if there were a line of communication stretching from the interior to an outlet to the sea. The line of forts along the lower river would point to the Sabi as the exit. Ruins have been reported north of the Zambesi, but they cluster most thickly in Mashonaland in close but not immediate proximity to gold workings, both ancient and modern.

A Varied Site.

These ancient ruins vary a great deal in their character. Four periods, or perhaps better classes, have been distinguished, ranging from the best or Great Zimbabwe type down to a class which has been described as exemplifying the efforts of local tribes to copy the Zimbabwe style of architecture. The latest classification suggests the possibility of two periods.

At Zimbabwe itself the area of the ruins has been estimated at between eighty and ninety thousand square yards, with a reservation that at one time it might have been larger. The ruins here fall into three groups. The Acropolis (Fig. 1) is situated on Zimbabwe Hill, a granite kopje, five hundred feet high with precipitous sides, the most abrupt facing the so-called Elliptical Temple. Access to the Acropolis is gained by a narrow winding stairway (Fig. 2) which in parts lies between gigantic granite boulders. On the kopje are numerous labyrinthine structures with

FIG. 1.
THE ACROPOLIS AT ZIMBABWE.
The Acropolis is situated on Zimbabwe Hill and constitutes the first group of the ruins. In constructing these walls of granite blocks no mortar was used.

enormously thick walls of rectangular granite blocks, or bricks. These have been obtained from granite boulders which scale off under atmospheric conditions and have been broken to a convenient and more or less uniform size. No mortar was used, and the walls are all built in regular courses with a batter or backward slope. On the most accessible side of the hill is a wall of massive structure, thirty feet high and surmounted by a series of small round towers three feet in diameter, alternating with monoliths. At the summit is a small flat space with huge boulders fifty feet high, huge monoliths and decorated pillars of soapstone. Below is a semi-circular space containing an altar covered with cement. Numerous openings and passages in the thick walls give access to the various chambers and court-like structures.

The Elliptical Temple (Fig. 4) which faces the Acropolis across the Valley of Ruins, is, like that structure, a labyrinth of walls and passages, the method of building employed being the same. Its greatest length is 280 feet, and its highest wall thirty-five feet above the ground. The thickest of the walls is sixteen feet at the base. A remarkable feature of the temple is the two round towers (Fig. 3). The larger must originally have been thirty-five feet high, and it is seventeen feet in diameter at its base. Both towers are built solid and with so pronounced a curving batter as to justify the epithet conical. A long narrow passage leads from the entrance to what has been thought a sacred enclosure. In both the acropolis and the temple the walls are ornamented by a dentelle or chevron pattern. The Valley of the Ruins, which lies between the temple and the acropolis, is a mass of remains which include traces of a number of elliptical buildings and an angular enclosure divided into chambers at different levels. This seems at one time to have been connected by wall with the temple, and was provided with round towers and monoliths.

The importance of Great Zimbabwe is evident. It must have been the residence of a paramount chief of great power who ruled over a wide dominion. The so-called elliptical temple was probably not entirely and solely a building used for religious purposes. Perhaps it was in part the royal residence and in part only used for ceremonial. The latter purpose is indicated in a number of details, but most of all, perhaps, by the conical pillars in which so many explorers and writers have seen the evidence of phallic worship, comparing it with the baetyls or sacred pillars which were a feature of the religions of Syria and the Near East in early times. While phallic emblems, both naturalistic and conventional, are not uncommon among the objects found in Rhodesian ruins, the phallic character of these monuments is purely a matter of conjecture, and taken in conjunction with the general character of the ruins does not seem probable. It does not appear to have been pointed out that taking this structure as a whole, and allowing

FIG. 2
STAIRWAY IN THE ACROPOLIS.
Access to the Acropolis is gained by a narrow winding stairway, which lies in part between gigantic granite boulders. Their size is emphasized by the figures in this photograph.

for the differences due to material, it presents an analogy to the sacred royal enclosures of peoples of the Great Lakes area of East Africa described by the Rev. J. Roscoe.

The purpose of the Acropolis, which is practically impregnable, is obviously that of a last place of defence, while the remains in the Valley of Ruins may reasonably be conjectured to have been the dwelling place of the members of the paramount chief's court, the elliptical buildings of which remains are to be seen being the residences of his subsidiary chiefs and headmen.

Among the other sites which have been examined, the most important are those at Khami near Buluwayo, and Dhlo Dhlo near Shangaan, the remains in both cases consisting of hill forts and dwelling places, or "slave pits," as the latter have sometimes been called. The hill forts at Khami and Dhlo Dhlo, where the remains indicate a large population and an occupation of some length of time, are of special interest in that they have been classified as belonging to the second Zimbabwe period owing to a slightly different and inferior style and method of building. The Niekerk ruins, first described by Dr. Randall-MacIver, are of special interest, as they cover what is one of the largest archaeological sites in the world, an area of something like fifty square miles, the remains here consisting for the most part of enclosures' roughly circular, on a hill surrounding a structure

FIG. 3.

CONICAL TOWER IN THE TEMPLE.

Two such towers form the most remarkable feature in the Elliptical Temple. The larger must originally have been thirty-five feet high, and its base is seventeen feet in diameter. The temple aces the Acropolis.

FIG. 4.

THE ELLIPTICAL TEMPLE.

This view of the "temple"—another group of ruins—suggests the extent of the Zimbabwe site, which covers at least 90,000 square yards. The stoutest wall is sixteen feet thick at the base.

which was either a place of refuge or a dwelling place. These structures, to which the name "slave pits" has been given, but which more properly seem to be pit dwelling places, are especially interesting. They are built on the side of hills—just where the South African native still builds his hut when conditions allow. A solid structure of granite slabs is erected out from the hillside in such a way that the sides increase in depth as the slope falls while the top forms a level platform. On this there are signs that one or more super-structures have been erected. Within the main structure a very narrow passage-way leads down into a chamber which seems to have been the main dwelling place—a more probable purpose than the alternative use suggested that it was a place of confinement for slaves. Nor is it probable that it was a grain store, though this is a purpose to which the natives sometimes put it nowadays.

Taking the ruins as a whole, it would look as if an object of their builders had been to resist the onslaughts of an attacking body coming from the north. The northern ruins are more strongly fortified than the southern. The latter have rather the appearances of being the dwelling places of a population which lived in more peaceful conditions.

From what precedes it will be apparent that Rhodesian ruins present a problem of a very remarkable interest. It lies, of course, in the question of the origin and date of stone buildings in such

numbers and of such a character in a country in which the use of stone for structural purpose is otherwise unknown. When we look for indications of an outside origin, nothing of any certain character is forthcoming

Earliest Records.

These buildings have been known since the time of the Portuguese in the sixteenth century, when the chroniclers made reference to them. Their information obviously was not first-hand ; it was probably derived from Arab traders. References are frequent to the kingdom of Monomotapa, in the customary grandiloquent phrasing of the time, a great " emperor " of the interior. In all probability Monomotapa is a garbled version of the title of a line of paramount chiefs of unusual power, who held sway over a wide area. It is suggested that their people were the ancestors of the present Makalanga. Though Jesuit missions spread over the country, it is doubtful if at this early date the Portuguese settlers themselves penetrated to the interior. Their intercourse was probably carried on through the intermediacy of Arab traders. In the eighteenth and early nineteenth centuries, little attention was paid to these ruins. When they again came into notice, and especially after the expedition of Mr. Theodore Bent in 1891, undertaken at the instance of the Royal Geographical Society and the British Association, they were attributed to the Phoenicians or were variously identified with Sheba, Ophir and Punt. Mr. Theodore Bent relied to a great extent on the character of the antiquities found in the ruins, especially a soapstone ingot mould, which he compared with an ingot mould said to be Phoenician found at Falmouth, and certain soapstone staves surmounted by carvings of birds which he considered identical with the birds sacred to Astarte. The latter, however, do not really seem to have parallels in any known culture ; nor is the ingot mould sufficiently distinctive to be conclusive. It has been compared with the ancient ingots of the Katanga and Northern Rhodesia. Further, there does not seem to be any evidence that the ancient had any knowledge of the African coast so far south. The furthest point mentioned in ancient geographical treatises is eight degrees south of the equator. We know very little of Arab activities in this direction before the tenth century, but those who have favoured Arab influences would claim much higher antiquity for the ruins than this. Although it has been admitted that the ruins are situated in agricultural country, they are in proximity to gold which was worked before any time of which we have record. The ruins themselves furnish abundant evidence of a knowledge of gold working in the form of objects of gold and crucibles. It is therefore generally accepted that the ruins are connected with gold mining. It has been estimated that over seventy millions sterling has been taken from these ancient workings—a conservative figure places the amount at fourteen or fifteen millions sterling—yet at no period in the world's history is there any record or evidence to suggest an influx of gold to this amount. Yet, again, a vast quantity of copper has been taken out of Northern Rhodesia and the Katanga at some, possibly, remote date. The Rhodesian ruins may be connected with this industry. What became of the product ?

When Dr. Randall-MacIver entered upon his investigations in 1905, the theory of an origin of considerable antiquity, possibly Phoenician, probably Semitic, held the field. As the result of his investigations on seven sites, he came to the conclusion that the remains were virtually homogeneous in culture and showed no succession of periods such as was claimed. While excavating in accordance with the strict canons of archaeological investigation, he discovered both at Dhlo Dhlo and at Great Zimbabwe fragments of Nankin china at the base of undisturbed homogeneous deposits. This demonstrated to his satisfaction that the ruins were mediaeval and at the earliest could not be earlier than the eleventh century, while probably they antedated the Portuguese by only a little. Further, as regards their origin, he was convinced that they were Kaffir. This view was based on the general character of the buildings, while many of the remains he considered to be foundations for super-structure of wattle and daub in the form of the Kaffir hut. The pottery, articles of copper, iron, and other remains which he found, he considered to be essentially native.

Acute Controversy.

Dr. Randall-MacIver's conclusions aroused fierce opposition, and controversy is still acute. Subsequent examination has not, however, brought forward any conclusive evidence to refute his view as to the date. Indeed, the most recent investigations tend to confirm it. Mr. Miles Burkitt found a Kaffir floor in the Acropolis containing Bantu pottery, which clearly had been in existence before the erection of the wall at that particular spot.

There would seem little possibility of proving a high antiquity for these ruins. The question of how and why they were erected remains.

I have to thank Mr. Miles Burkitt for the illustrations which are from photographs taken by him on his recent archæological tour in South Africa.

Correspondence.

TELEVISION.

To the Editor of DISCOVERY.

SIR,

With reference to your Editorial Notes in your issue for November last, and the criticisms of Mr. Pullin in your issue for December, I should like to point out that the idea that it is possible in television, as against ordinary photography, that a sort of sketch can be provided sufficient to convey the requisite mental impression, and that, therefore, full details such as photography gives are unnecessary, presumes, in order to attain success, a kind of mental process on the part of the apparatus to distinguish between essential and non-essential details which would be almost human, and which no mere mechanism can be expected to carry out.

Furthermore, I should like to say that in taking the attitude with regard to modern television methods that I have, I believe that, holding as I do that the present workers at the subject are engaged in a hopeless quest which can never lead to real success, the B.B.C.'s decision to leave the matter alone is no holding up of legitimate experiments, but only a very proper objection to lending its influential and unique organization for the benefit of Stock Exchange speculators, the existence of whom are, in my opinion, a positive detriment to real progress.

My views on the subject of the scandals of the speculative over-capitalization of incompletely worked-out patented inventions have been dealt with in my letter in *The Times* newspaper for 30th November, 1928, and have, I find, met with general approval in scientific circles; so that I scarcely think that I need add any more.

Your obedient servant,

The Athenaeum, Pall Mall, S.W. A. A. CAMPBELL-SWINTON.

To the Editor of DISCOVERY.

SIR,

To judge Mr. Baird's achievement of television by comparing the result with those of other photographic processes is surely a mistaken approach to the question. Because still photographs, as you have remarked, are "by their nature permanent records," they require a degree of detail that must bear equally well momentary or prolonged inspection. But in viewing a transient image—the only kind of image that can possibly be presented in television—the inability of the human eye to distinguish the image presented at any one moment of time is the paramount factor.

To give a simple analogy, a slow-motion film of a galloping horse reveals actions, which in the ordinary way escape the eye, and which indeed seem almost grotesque when viewed as separate pictures dissociated from the series. Again, if an instantaneous photograph of a cinema screen is taken at the moment when one picture is being superseded by the next, a blurred effect results on the photographic plate, though because the pictures are travelling at more than sixteen per second this effect escapes the human eye.

To the layman, therefore, the fact that only one (admittedly inferior) still photograph of a television image has so far appeared in the newspapers does not seem to be relevant to judging the moving image as it appears to the eye.

Yours, etc.,

Orpington, Kent. C. E. HUGHES.

IS THERE A SURPLUS MALE BIRD POPULATION?

To the Editor of DISCOVERY.

SIR,

Stolzmann's theory on the above subject as set forth in Mr. Vassall's letter (November) has been familiar to me since boyhood from the writings of the late Mr. C. J. Cornish, but has always appeared to me to involve a logical difficulty.

There are two ways in which Natural Selection may be supposed to operate, and it is important to distinguish them. When two fully evolved species come into contact which have never been so before, as when man introduced the brown rat into fresh countries, or when the relations of two species are changed owing to some other change in their environment, Natural Selection will decide which will survive, but the surviving species may well remain practically unchanged, as the rat has done. The action of Natural Selection as a species-forming agent is different. In this case an existing species must be supposed to be changed or divided by Natural Selection within limits set by the laws of growth, correlation, variation, heredity, etc. Working in this way it would appear incapable of producing the effect Stolzmann claims for it, since a selection acts on individuals within the species, so that individuals bearing a character harmful to them but good for others will be eliminated and the character with them. Thus any benefit produced by the reduction in the number of males through the destruction of the more brightly coloured ones will acrue to the more dully coloured and their offspring, and so increase the dull colours, not the bright.

Stolzmann's theory may, however, be applied as follows: If the foregoing argument is sound it cannot account for the production of species containing brightly coloured males, but may explain their preservation. If any cause, such as sexual selection, acting within the limits of a species produced brightly coloured males, the species so produced might be preserved in competition with others. In other words, in the case of every species there would be opposing causes, some tending to produce bright males, others dull ones. Stolzmann's theory might account for the preservation of species in which the balance turned in favour of brightness, but for the existence of the balance or the fact that it did so turn. In this way it would be supplementary to the theory of sexual selection rather than opposed to it.

In conclusion, with respect to Mr. Vassall's last sentence regarding brilliantly coloured males in polygamous species, may I remind your readers that Darwin in the "Descent of Man" adduces a considerable body of evidence to show that polygamy and bright colours in the males have a tendency to go together?

Yours sincerely,

Whitethorns, Berkhamsted. H. WALLIS CHAPMAN.

INTERNATIONAL EDUCATIONAL SOCIETY.

To the Editor of DISCOVERY.

SIR,

Since my Society published its first list of educational lecture-records in May 1928, it has met with a very encouraging reception. Though it has no funds for advertising, the Press in all parts of the world has been most friendly and helpful. We have received a very large number of enquiries, especially from New Zealand, quoting the notes which you were kind enough to insert some while ago in your columns.

May I take this opportunity of conveying my thanks.

Yours very truly,

91 Petty France, S.W.1. E. J. KING, Secretary.

Reflections on the Origin of the War.

By Ludwig Herz.

Below is a free translation of a Berlin newspaper article which reviews Mr. D.C. Somervell's "History of Western Europe 1815-1926."† As providing a comparison of German and British views on the origin of the war, published just ten years after the Armistice, this new material has much historical interest.*

In Benn's "Sixpenny Library," a collection of popular writings on all spheres of knowledge widely circulated in England, there is a "History of Western Europe, 1815-1926," by D. C. Somervell, M.A. So far as I have been able to ascertain, he is not known in Germany. But as men like Massingham and Hilaire Belloc collaborate in this series, and books by Gooch, the editor of the great English collection of documents entitled "Germany," and by Poincaré ("How France is ruled"), appear from the publishing house of Benn, it seems justifiable to assume that Somervell enjoys in England the reputation of an historian. His work of only eighty pages gives not only a skeleton of the history of a century, but concentrates upon what is most important. It is essential for publishers who issue books for popular reading not to enlist the co-operation of mere individuals, but of writers whose views correspond to those of a large circle of readers, either educated or eager for education. One may fairly assume that the view of history represented by Somervell is shared by a large section of his countrymen.

The Versailles Treaty.

The author's standpoint, which does not—and this is characteristically English—reckon Great Britain as part of Western Europe, is disclosed in his judgment, or more accurately his condemnation, of the Peace Treaty of Versailles. He compares it with the proceedings of the Congress of Vienna in 1815, whose final result has also been much censured and little praised. All peace treaties, so he puts it, are concluded in unfavourable circumstances, in haste, in the heat of passion, and obviously badly.

"War is so painful an experience that, while it lasts, we console ourselves for our sufferings by persuading ourselves that they will be compensated by all kinds of future benefits. War is a political and social disease, yet we prefer to figure it to ourselves as a kind of surgical operation. We expect to be better when it is over than we were when it began. During the long years of fighting many people said that this was a 'war to end war,' that it was not merely a war against Germany and her allies, but against something called militarism. Some assumed that Germany and her allies were the only States that had been guilty of militarism, and that their complete defeat would secure the end in view. Others, better informed, knew that militarism was an ancient and deep-rooted vice of nations [and that past history showed none to be wholly free from it], but they hoped that victors and vanquished alike would have learnt wisdom.

"The Germans had been excluded from all share in the construction of the treaty. When it was presented to them they declared it to be a breach of faith, in that it did not accord with President Wilson's Fourteen Points as embodied in the terms of the Armistice. In fact, they declared that, if the war began with the tearing up of one scrap of paper, it ended with another. Perhaps they were right; and, if we ought to feel ashamed, their assumption of righteous indignation was more than a little ludicrous."

Compromise Necessary.

Somervell holds that binding the Germans to pay Allied war pensions was a misinterpretation of the Treaty. The drawing of the new frontiers frankly demands alterations. But to demand it at the time would have been a remedy worse than the disease. In this matter he trusts that the League of Nations will carry out the fulfilment of just claims. His final conclusion amounts to this, that the Peace of Versailles was a part of the war, and bears the marks of the passions of war-time. "If we are to forgive the war, the Germans must forgive the Peace. Not by the war and the Treaty of Peace, but in spite of both, must that new world be created for which idealists have prayed and soldiers died."

Somervell's general view of the world is also that of the old English moderate pacifist Liberals. Politically he walks in the footsteps of Campbell Bannerman, in that he also regards the British rule of the sea as necessary to her existence, and not as a danger to peace, since the great fleet serves only as a means of defence. The preliminary history of the war he bases on the fact that Europe, in contrast to the time of the Berlin Congress, had become divided into two allied groups. "After 1907 there was no sphere for an 'honest broker.' Grey did everything in his power to reconcile faithfulness to his friends with impartiality, with the result that Germany and Austria laughed at his impartiality, and France and Russia occasionally doubted his good faith."

* "Die Vorgeschichte des Kriegen in Englisher Beleuchting." Ludwig Herz. *Der Weg zur Freiheit.* (Berlin: November, 1928).
† Volume No. 10, *Sixpenny Library.*

For Germany it appears to him of importance that the prestige of the divine right of the Hohenzollerns inevitably decayed. It could only be restored if the people were convinced that without the Hohenzollern militarism they would be the prey of their neighbours.

"Thus an atmosphere of international unrest, of recurring crises, and of rumours of wars was absolutely necessary, not to Germans, but to the maintenance of the Hohenzollern system. The militarists could be secure only so long as Germany was insecure. They therefore cultivated insecurity. If insecurity was needed Austria furnished the commodity in abundance, for here was an anachronism far less tenable than Bismarck's. . . .

"It seems probable that the party [of Francis Ferdinand, the successor to the throne], had already resolved on war with Serbia before his assassination provided them with a pretext. Such a war would no doubt involve war with Russia, but Germany would see to that. Germany gave Austria a free hand against Serbia because the conquest of Serbia would abolish the one obstruction between Austria and Turkey, and give Germany continuous control 'from Berlin to Baghdad.' . . . The complicity of Serbia in the murder of the successor to the throne was not proved."

Italy's contribution to the catastrophe Somervell sees in her attack on the Turkish province of Tripoli.

Russia's military power had been overrated ever since Napoleon's disaster in 1812. The danger-point of this autocratically governed country lay in the personality of the lamentably weak and foolish Nicholas II. The reform of the army, which would be completed in 1917, gave every year another trump into Russia's hand. It is possible [in Somervell's view] to lay upon Russia a share in the catastrophe, but by no means upon France. Alsace-Lorraine had not yet been forgotten; the statue of Strasburg on the Place de la Concorde was certainly clothed in mourning; but "revenge" even after the conclusion of the Entente, no longer played a part in practical French policy. The opposition of the Alsatians to German rule was disappearing.

England in 1914.

The description of English opinion is most interesting. Of the last days Somervell gives the following sketch:—

"Great Britain, though she had emerged from her diplomatic isolation, was intensely pacific. We were determined to maintain our naval superiority, which we very reasonably regarded as an insurance of our own safety, and not at all as a weapon of offence. Most English people took little interest in the recurrent European crises, and regarded threats of war with a scepticism which proved to be misplaced. The notion of Germany as a 'national enemy' left them cold. For seventy years Russia had figured as the national enemy, and we had only fought her once, and then, it seemed to be agreed, unnecessarily. Most English people were much more interested in the conflict of Lords and Commons, the development of unprecedented discontent in the great mining and transport industries, the militant suffragist agitation, and the prospect of civil war in Ireland than in anything that was happening on the Continent. Ignorance of the suppressed conflicts raging in Europe was, in general, profound. After the war had begun historians came forward with popular booklets informing a bewildered electorate 'Why we are at war.' Such booklets would not have been needed in France or Germany: our ignorance is the best proof of our innocence."

Serbian Complicity.

In the statements of Somervell, who never uses the word "war-guilt," and touches the subject itself only by the way, the sentence which says that the complicity of Serbia in the murder at Serajevo was not proved, must be firmly disputed. That the Serbian Government as such had a hand in the game, has never in any quarter been seriously asserted. The circumstantial evidence that the Russian ambassador in Belgrade, or his military attaché, were accomplices of the plan, is no less than conclusive. Since the disclosures of the former Serbian Minister of Worship, Jovanovicz, who was perhaps himself unconscious of the implications of his information in the paper, "Blood of the Slavs," it is certain that leading quarters in Belgrade had full knowledge of the plan of murder. They did not take the smallest trouble to stop it, and indeed were unable to hinder it, since the "Great-Serbian black hand," to which even the successor to the throne, and the Kingmaker, Dimitrivitch-Apis, belonged, was stronger that their opponent the "Little-Serbian" Minister president, Oatschitsch. Even the repeated explanations of the Servian Government that they warned Austria, but only on vague and indefinite grounds, prove that they must have had wind of the murder plot. It is quite unintelligible why the Austro-Hungarian Government, even during the war, always denied these statements, which support their assertion of the complicity of Serbia in the crime.

Somervell does not enter into the controversy as to the moral complicity of the Serbian Government which tolerated the measureless anti-Hapsburg agitation represented in England by the pro-Serbian Seton-Watson, and the anti-Serbian Edith Durham. Before the outbreak of the war, Dr. Dillon, the Vienna correspondent of the *Daily Telegraph*, had clearly pointed out how the Dual Monarchy must consider itself endangered by the Serbs, who in spite of all promises and arrangements would never assure "neighbourliness." He sees the danger-points in the agitation among the Ruthenes, supported by Russia, in the scheme for the union of Montenegro with Serbia, in the pan-Slavic declarations of Serbian official personages, in the instigations of Serbs in Bosnia, in the estrangement of Roumania from her old allies, and in the isolation of Bulgaria. The

turning point in the arrangements between Germans and Slavs lay in the first instance in Petersburg, in the second in Berlin.

Still, long after the attempt, opinion in England was against Serbia, as also were the English Government—particularly King Edward VII on the ground of dynastic solidarity—which had long refused to recognize the Kargeorgovich, who through the horrible murder in Belgrade [in 1903] had gained the throne. Anti-Serbian feeling found its strongest expression in the pretty notorious *John Bull*, a paper with a circulation of a million. It opened the campaign [July, 1914] with the publication of a document which, professedly dropped on the editorial table, was so obviously a mystification that its use can only be explained on the ground that the end sanctifies the means. It was supposed to be the facsimile of a half-burnt piece of paper from the archives of the Serbian embassy in London, which, though destined for destruction along with other papers, had not been thoroughly burnt. It contained a secret document, which when deciphered into Spanish, disclosed the issue of a sum of money for the getting rid of an archduke indicated by a pseudonym. The campaign ended with the famous leading article—"To Hell with Serbia." The opinion of the average educated Englishman about the impending conflict was expressed in a picture in *Punch*, in which an eagle is about to fall upon a cock which is crowing defiantly. Behind the cock a bear is seen. Below we read—'Austria, your behaviour does not please me, somebody must stand behind him."

French Policy.

Somervell's thesis, that "revenge" had come to form no part of the practical policy of France, cannot be accepted in this absolute form. It is certainly true that France would not have sought for a pretext for a war for the lost provinces, but their recovery was more than a wished-for dream in the minds of leading politicians of all parties. What is commonly, but not quite accurately, called the "idea of revenge," prevented the existence between France and Germany of what the English call "goodwill," even if a reasonable and peaceful man like Rouvier—who in the language of war would have been branded as a pacifist—directed policy, particularly after the rise of a new sense of power in the French General Staff, in the early years of the century. The way in which as a result of the anti-church legislation the military idea spread from the inner monarchical corps of officers to the *haute bourgeoisie*, even beyond the already nationalistic Paris, forms one of the most interesting episodes in the mental currents of French history. He who would gain insight into this chapter should read Anatole France's four "Bergeret" romances and his "Revolt of the Angels."

One has also only to recall how the demonstrations before the statue of Strasburg, ordered by authority, were multiplied; how Millerand, as Minister of War, popularized the idea of defence by tattoos and torch-light processions; but in particular the danger to peace aggravated by the ups and downs of the Dreyfus case—even if it be admitted that preparation already endangered peace, and that German policy was an all too active stimulus to the Chauvinism already latent in France, or, if it be preferred, to her ever vigorous national feeling.

"Poincaré is War."

Poincaré and Delcassé are the emblems of the definitely anti-German policy of France. The younger Fallières has put it on record that after Poincaré's election, his father cried—"Poincaré is War." Due weight must be given to what Colrat, the secretary and friend of the new President, wrote in *Opinion*, on the 18th December, 1918, under the intoxicating influence of victory: "Metz and Strasburg, that is the coping stone of a policy. This policy was not always easy to follow, either before the war, or during its course. Yet Poincaré has pursued it with an unfailing skill, which when necessary sacrificed secondary objects to the primary, the means to the end, and men to the task." We need only also refer to Isvolski's telegram to Sassonov, published by *Humanité*, in which we read: "According to Poincaré, it is of the highest importance to prepare French public opinion in advance for the necessity of taking part in a war which may break out on the Balkan question." According to this also Poincaré, though contrary to all probability, so expressed himself as to suggest a Russian subvention for the French Press. But the reports of the Belgian ambassadors, who were keenly on the watch, because their country stood to be ground to powder between the great millstones of the two powers, agree above all in the anxiety as to the danger to which the keenest representatives of the two great powers might be pledged. And when Poincaré sent Delcassé as ambassador to St. Petersburg, Jaurés asked anxiously whether that was the sign of the future policy of the new president.

That Alsace-Lorraine, even if not an object to be attained by a war, was at least an object possibly attainable by a treaty after a war which might not improbably break out on some question in the Near East, is witnessed by the following confessed records

of Georges Louis, the French ambassador at Petersburg, removed by Poincaré as not sufficiently energetic :— That the recovery of Alsace-Lorraine was the consideration in exchange for the Russian occupation of Constantinople ; that since Montebello's time that was the meaning of the Double Entente. After the conclusion of the Entente between France and Great Britain, Delcassé expressed himself thus to Wallace, a trusted friend of Edward VII—as stated in Sidney Lee's biography of the King—that France had abandoned the Dream of Egypt for the Reality of Alsace-Lorraine. Still more striking is what Paléologue put before the Empress Eugénie. As he tells us in his recent book, " Conversations with the Empress Eugénie," he narrated to the Empress that the former French Ambassador in Berlin, Baron de Courcel, had said, as early as 1905, that Bismarck himself had given him to understand that the suspicion of the existence of such an alliance, as the Triple Entente subsequently became, would have been regarded by him as a ground for war. Further, in the post-Bismarckian days Germany had lost prestige through the changes in the relations of the powers, and was hampered in Balkan affairs through her alliance with Austria. " If," he said, " God gives you a normal spell of life, say another twenty years, you will surely see the restoration of Alsace-Lorraine to France." Paléologue then described Delcassé's policy, that new possibilities in the diplomatic game of chess might arise from Germany's policy of an advance to the East. " In this day we may hope, possibly without recourse to war, to recover our lost provinces by the power of our alliances. The solution of the crisis will demand alterations of territory, regulation of frontiers, perhaps even an exchange of colonies. Is it contrary to good sense to assume that in such circumstances, in which she might need our support or our neutrality, Germany might not think it too dearly bought by a revision of the Treaty of Frankfort ? "

Divided British Cabinet.

As regards Somervell's account of the last days before the war, in spite of his limited space room should have been found for the differences in the Cabinet :— Churchill, Asquith, Grey, for war on account of the pledges given in the Entente ; Lloyd George for war only after the violation of Belgian neutrality ; Morley and Burns as yet not so much against war as to resign, but could not finally be won over. And nothing is said of the influence of the war party on the Cabinet—especially of General Sir Henry Wilson, Maxse, the editor of the *National Review*, Amery, one of the wildest men in Parliament—or of the war-supporting letter of the Conservative party.

It is true that many pamphlets were published to explain why England took part in the war. But it is only true in a limited sense that we can infer from this the existence of a peaceable public opinion. Previously in a well-known series of articles in the *Fortnightly Review* in 1887 the theory was propounded that the time was over in which England would wage war (" our fighting days are over "). The English conceived, as once the world-ruling Romans had done, that since they no longer meddled in continental affairs, the battles waged by their professional soldiers in Asia and Africa were only punitive expeditions within the Empire. But during the decade before the war, there were at least two crises in which the English would not have had to be taught—" why are we at war ? "

The Dogger Bank Incident.

These occurred after the letter of the Emperor William II to Lord Tweedmouth, and after the incident on the Dogger Bank, when the Russian fleet, sailing against Japan, had attacked an English fishing fleet, which the Admiral mistook for Japanese torpedo boats. But it was a question how in 1914 *Truth*, a well-known society paper, wrote about a dispute which concerned England as little as a quarrel among the inhabitants of Saturn. Two satires, published in *Punch*—a poem, entitled " The logic of the Entente," and a speech, " Mr. Porkins in Olympus," have this as their feature—the whole of history down in the Balkans is for Englishmen a matter of no concern. That proved right so long as the conflict was confined to Austria and Serbia. The situation changed as soon as Russia came in. On that the mechanism of alliances worked automatically.

The people did not know how far the Government at least had pledged itself in engagements of honour to France, and seemed to be on the way to being engaged to Russia. Already on the 11th June Grey had a question asked him as to the obligations of the Government, exactly such as had on the 10th March, 1912, been addressed to Cecil, and to Asquith on the 24th March, 1913. The answers were formally true. The three statesmen gave themselves up to the delusion that their hands were still free. The Conservative opposition probably knew more about the conversations with the French, than the party supporting the Liberal Government. From this we can partly explain why from the first the Conservative press painted on the wall the danger of a European war, and preached the necessity of Great Britain taking part in it. At its head was naturally *The Times*,

whose attitude had remained inimical to Germany from the time when its very influential and conceited representative, Herr von Blowitz, believed himself to have been treated without sufficient respect by Bismarck. The Liberal papers, specially the *Daily News* and the *Manchester Guardian*, did not, in their fundamentally pacifist position, know that a storm was coming. They opposed any participation in a continental war, and saw even in the violation of Belgian neutrality no immediate *casus belli*. During the last days committees of distinguished Liberals were formed who carried on a campaign against any warlike defence of Belgian neutrality.

England's Declaration.

England's declaration followed, after Grey—in a masterly speech, which may be compared to that of Marcus Antonius in Shakespeare's " Julius Caesar "—opposed only by a few isolated individuals, had brought Parliament round to his side. " Yes, indeed, we have lost—and you have won," wrote the editor of the *Daily News* in December to Lord Northcliffe. " Your claim to be a genuine prophet of war is not disputed. . . . You throw it at us, that we prophesied peace. Certainly, we not only prophesied peace, but worked for it, as you prophesied war and worked for that. For twenty years you have been the incendiary of journalism You have spent your life in a shameful slavery to the changeful passions of the hour. Can you justify yourself from the charge that you are an accomplice in this world-wide misfortune? You fancy you can slander us because we do not share your guilt. You are mistaken. We have no shame and no regret." It is quite intelligible that the Liberals, once war was declared, adopted the standpoint—since we are at war, we must win. But they went further and seized upon Asquith's words, in his speech at the Guildhall on the 3rd September, 1914 : " With cool deliberation and a clean conscience we see ourselves with the whole power of the Empire placed in the bloody decision between Might and Right." Irene Cooper Willis, a member of the Labour party, has in the first of three little books (1919 to 1921)—" How we went into the War," " How we got on with the War," and " How we got out of the War "—shown by means of the leading articles of the great Liberal papers the change of public opinion, and particularly how the Liberals in honourable self-deception and for the quieting of their own consciences made the war into a " Holy War." These little books are now published in an enlarged shape in New York, as " The Holy War." The pamphlets of which Somervell speaks, himself a Liberal, as his admiration of Grey shows, served to propagate this idea of the war. Its earliest champion was H. G. Wells, whose war novel, " Mr. Britling sees it Through," along with Oppenheim's " The Devil's Paw," are masterpieces of propaganda.

In the foregoing pages objection has only been raised to Somervell's book on matters of fact. With the judgments expressed we in Germany shall not fully agree, even if he avoids the word " War-guilt," and only between the lines allows it to be recognized that he lays a chief part of the responsibility for the war on Germany. But it is an idle undertaking to quarrel about the division of light and shadow. The difference of standpoint alters the perspective, and explains the relative clearness or dimness with which things show themselves in the complicated entanglement of appearances. But even with a false apportionment of light and shade, there remains a morsel of truth in the indictment. That indeed makes it dangerous, more dangerous than a propaganda of lies. And so it appears useful [to a German writer] for once to show how the picture of these events strikes an Englishman, who aims at historical objectivity. So long as we do not know the views of foreigners, we shall talk over one another's heads in the discussion.*

* Mr. D. C. Somervell will reply to this article next month.

Raw Materials of Commerce.

A COPY has been sent to *Discovery* of the first number of a new publication, under the above title, which will be completed in twenty-four fortnightly parts. As is pointed out in the introduction, in former years little attention was paid to the method of collection of wild products, and to the preparation of the raw materials for the market. Many drugs, gums, resins, barks, and roots were gathered by native collectors, it may be, in some forest of the tropics, and brought, either in the crude state or roughly prepared, to the local market or seaport. Sometimes the exact source of the product was unknown, and, when the demand exceeded the supply, similar but inferior material was substituted for the real article. In other instances, the plant product was collected out of the proper season, and consequently the content of the essential principle varied greatly.

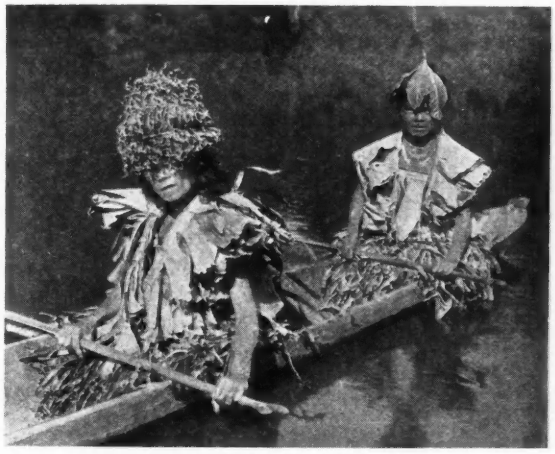
With the advent of well-organized scientific control of industry, however, conditions have undergone a change, and much has been done to ascertain the true source of the product. The new work is planned in four sections—on vegetable, animal, mineral, and synthetic products—and should fill an obvious need among modern works of reference.

On The Fringe of Civilization.

By Paul Wirz, Ph.D.

The coasts of the East Indies group contain many island peoples, fast diminishing in numbers, whose primitive way of living is still undisturbed. Two such races are here described by a German ethnologist—the islanders of Mentawei (west of Sumatra) and of Sentani in Dutch New Guinea.

THOUGH civilization sails and marches right through the islands from Singapore to Hongkong, and to New Zealand, many of the different primitive races remain practically untouched. The Mentawei islanders, the people round about the Lake Sentani in north Dutch New Guinea, and in hundreds of different islands north of Australia, live as their forebears must have done for many centuries, completely ignoring the influence of the West, which comes right up to their shores—then passes on. Yet they are a companionable people, living in organized villages, and extracting all the pleasures they can from life by a succession of festivals, despite almost constant fever and the drawbacks inherent to their mode and place of living. The festivals are important. To the people of the south coast of New Guinea, as elsewhere in Papua, the regular festivals are part of their life blood. On entering a village at any time, the villagers will be found either preparing for one of the feasts, or actually engaged in these traditional rites. In earlier days the first essential in the preparation for a festival was a successful head hunt. Now this is an extremely rare event. Civilization, and the firm hand of the white invader has stayed this gruesome practice. And so to-day there are only the mimicry and the fantastic, weird decorations.



MENTAWEIAN WOMEN FISHING.

When occupied in fishing or on the plantations, all the women wear similar dress—a costume of grass and split leaves, with a headress of banana leaves.

West of Sumatra there is a remarkable archipelago, the Mentawei group, which consists of four large and one hundred and twenty smaller islands. The most northerly and at the same time the largest is of about 4,000 square kilometres, and, therefore, nearly as large as the more northerly island of Nias. Yet it has only about 7,000 natives, whereas Nias supports about 136,900. The Numbers in the Mentawei islands are falling steadily, and the disappearance of the islanders is almost inevitable. Malaria, from which not a single native is free, must be held the chief cause. Although only ninety miles from the coast of Sumatra, the Mentaweians differ from their neighbours to such an extent that relationship is doubtful. Also the differences between them and the people of Nias are not inconsiderable, not only in bodily structure, but also in customs and habits. Their culture is extraordinarily primitive. It is no use here to look for weaving, pottery, or metal work, which are highly developed in Sumatra and Nias. Cooking is done in the sections of bamboo which are collected daily in large numbers. Basketwork is very crude; only rattan is used. The baskets are employed for all sorts of purposes. Coffins, for example, are made of this material, and instead of burial are placed above the marshy ground on wooden piles. Of a stone-age no evidence has been found; but that a shell period is probable is suggested by the mythology of the islands.

Clothing is spare as is to be expected, expecially with the men, who wear only a girdle of beaten bast. The women, however, provide a surprise in this regard. At first sight it might be imagined they are masquerading. At home the loin cloth is worn for practical reasons; but when they go out this is discarded and they dress themselves up—as is the Papuan mode—in a costume made of grass and split leaves. One reason is for protection against the rain (and in the Mentawei islands it rains almost every

day). The upper part of the body is covered in this way for practical reasons, rather than from m desty.

When the Mentawei woman leaves the house, she must dress up. There is no variation in fashion—the costume is always the same in style. The dresses are always worn when fishing and in the plantations. A head-dress of banana leaves goes with the costume. So clad, protected against rain and sun, the woman takes her seat in the canoe and proceeds by water to her work. On her return home, the leaf-dress is removed and hung up to dry. On the average the dress is renewed each month : it gives little trouble to make and costs nothing. The men and boys tattoo themselves with a peculiar linear ornamentation, the lines running up over the face and over the arms and legs. Even the backs of the hands are carefully decorated. The women are much less tattooed.

The weapons of these people provide a surprise, for besides shield and spear, they have the bow and arrow. Neither the inhabitants of Nias, nor the neighbouring peoples of Sumatra possess such weapon. It suggests a throw-back to some very early migration. How, when, and what that migration was is unknown. The Mentaweian have much in common with the Nias natives, but still more with the Andaman islanders. Ethnologically they would appear to approach the Dyaks. In physique, however, they are more like Polynesians, especially the natives of the Marquesas islands and the Hawaiians. The Mentaweians themselves say that once upon a time a boat went ashore on the stormy west coast of the chief island Siberut, and it was with this boat that their forebears came to Siberut.

All four islands, and in particular Siberut, are remarkable on account of their very unfavourable terrain. A great part of the land is almost always under water. There are no wet and dry seasons ; rain falls almost every day. Agriculture is negligible. This is natural in the circumstances ; further, it must be remembered that hard stone does not exist and the number of inhabitants is small. Malay traders live on the coast ; the Mentaweians without exception live on the rivers, and all traffic is by water. No one goes afoot. This is much as among the Dyaks of Borneo. There are, however, miles and miles of pathways of felled tree trunks through the swamps ; but these are used only by the military patrols, whose long marches are not at all pleasant.

Like all Malayan peoples the Mentaweians are real water-rats. The greater part of their lives is lived in canoes. Boys and girls learn to paddle at a very early age, and the women go to the plantations or fishing grounds in canoes. The collection of crabs and molluscs is especially women's work. The men prepare the sago plots, hunt monkeys, deer and pigs. Every successful hunting party is wound up with a special ceremony, with a ritual division of the spoils in the meeting house. Then follows the cooking of the meat in bamboo vessels. During this ceremony the roll of drums informs the neighbourhood of the happy event—but not to call all and sundry to the feast. On the contrary, strangers are not allowed to enter the meeting house during the ceremony, and the drums warn them to keep away till the feast is over. Then comes the dancing, if it may be so called, for it is merely the mimicry of animal actions. It is very simple, like all things about the Mentawei islanders, who on closer acquaintance are found to be natural people, unspoilt, well meaning, grown-up children.

NATIVE CRAFTSMANSHIP.

This stone seat, carved like a water fowl, shows that among these people sculpture has reached a stage more advanced than their simple hollowed canoes would suggest.

In contrast with the Mentawei islanders, let us now turn to another water-dwelling people—the inhabitants of Humboldt Bay, on the north coast of Dutch New Guinea. There Lake Sentani slumbers, dreaming of ages before our civilization and undisturbed by modern hustle. The name of an earlier settlement was Setam, from which Sentani is derived. It may be reached from the small settlement of Hollandia, on Humboldt Bay, by craft propelled by muscular Papuans. The traveller passes Entsau and Tabadi—age-old villages of pile dwellings built in a jumble over the water, then goes for several hours by land,

with a small army of native bearers till on emerging from the grassy bush, he looks down from the rising land, on to Lake Sentani. It lies in a hollow. As if rising straight out of the water the mountain overshadows the landscape. It seems to rise sharply out of the sea on one side and the lake on the other, and to form a high bridge between the two. On through the sago bush and along a winding rivulet of fresh drinkable water the bearers lead the way to the lakeside.

At first no canoe or craft is visible, but suddenly one of the bearers disappears and a moment later returns with a frail dugout arrangement, the *ifia*, or man-boat, which is just large enough to carry one man at a squeeze if he is not too big. To the stranger it is always a puzzle how anyone can sit in and paddle such a craft without capsizing, and it remains a puzzle to the end. Yet the Papuan youngsters learn the knack when cutting their teeth and the smallest of them possesses his *ifia*. It requires considerable skill and judgment to control. The boy lies in it and paddles with his hands; as the lad grows his boat grows in size with him. Then he learns to use paddles and almost before he can walk properly he navigates the lake with confident assurance. The *ifia* is a small narrow, and very light dug-out, scarcely ever wider than one foot nine inches. The top edges are turned in somewhat, so that the sitting place is even less roomy than it might be. The canoeist, therefore, sits not in the craft but astride, frequently letting one leg swing over the side in the water; with the other foot he skilfully bails out water which enters freely into the dug-out, in a manner open to admiration and impossible to emulate.

In this uncomfortable way the Sentani lake dwellers travel for hours without showing any signs of fatigue.

THE SENTANI LAKE DWELLERS.

Like the Mentaweians, the natives of Sentani are "water rats," and in their lake surroundings learn to paddle a canoe almost before they can walk.

MENTAWEIAN BURIAL.

The coffins here seen on raised burial platforms are made of bamboo, the principal material used among the Mentaweians for construction purposes.

When fishing, visiting distant settlements, hunting or going to the plantations, the "road" is always by water. There are no pathways anywhere near the shore of the lake. But the miserable dug-out has one advantage: it is so light that the Papuan can propel it at great speed without special effort. When going with full power they flash across the water like fish, and, indeed, the craft has the form of a fish, as the Papuans remark, for each part has a name which corresponds to the similar part of a fish.

Besides these one-man boats, there are the women's boats which are carved out of tree trunks and are sometimes very large. A man will only travel in a women's boat on exceptional occasions—a woman never enters an *ifia*. Only the *amberi* (foreigners) use the women's boats, though they are also employed for the transport of copra and masoi bark over the lake. These large dug-outs are often very finely carved. The youngsters use them, and it is amazing how much of a traveller's baggage they can safely stow away in one boat. In the morning the lake is always as calm as a mill pond, but punctually at noon the wind rises and whips up white-horses. Then the *ifias* disappear from the wide waters into the calmer rivers.

The visitor to Sentani has a royal welcome from the naked youngsters and numerous grunting swine, and the chief awaits at the entrance of his house, an elderly man with thinning hair, as naked as the rest, and just as dirty. He is distinguished from his subjects solely by a pair of ear-rings, which he alone has the right to wear. He offers the best place in the house to the guest. The chief's house on Lake Sentani is very old and built on piles of iron-wood sunk into the bed of the lake. It is remarkable that these people with their

primitive tools hauled these great tree trunks over a long distance from the forests, then cut them up and worked them at a time when probably they had no knowledge of iron. The wooden pillars supporting the structure are all set upside down—that is to say, the root-end of the tree is upper-most, with two carved wings worked out of the root-ends. Some of these piles are worked and carved all over. Generally, they show a giant crocodile on one side, while human forms appear on the other side. The two "wings" have long chains of lizards or such like reptiles; in between are worked spiral lines and other ornamentation. In one house there may be forty or more such piles, each one carved differently from the others.

Once settled in the chief's house the stranger is besieged by the women and children of the settlement, who bring melons, fish, and sago as offerings. If given a spoonful of salt in exchange they are jubilant—for salt is a great delicacy. The children suck it like sugar-candy, and should a few grains fall to the ground there is a scramble to regain them. Thereafter, when a youngster meets the stranger he pesters him for salt. Here on Lake Sentani salt-hunger is much more marked than anywhere else in Papua. It must arise from the nature of the food which is mainly made up of small lake fish—containing little salt—and some sago. Pork and other meat is only eaten on special occasions.

Among the Stars: A Monthly Commentary.

By A. C. D. Crommelin, D.Sc., F.R.A.S.

THE planets mentioned last month may still be seen, except Mercury and Uranus, which are now badly placed. Venus is at her greatest elongation, 47 degrees east of the sun, on 7th February. Neptune is in opposition to the sun on 19th February; it is about a degree east of Regulus. The brightest occultation during the month is that of Tau Tauri, magnitude 4.3; it disappears at 11.47 p.m. on 17th February, and reappears fifty-two minutes later (as seen from London).

The New Comet.

The identity of Forbes's comet with the comets of 1818 (Pons) and 1873 (Coggia-Winnecke), suggested in these notes last month, has now been confirmed. It appears to have made two revolutions since 1873, so that its period is about 27½ years. The following are its elements: Perihelion 1928, November, 5.0, Arc from node to perihelion 195° 54′, Node 250° 8′, Inclination 28° 55′, Eccentricity 0.9181, Perihelion distance 0.7451, Aphelion distance 17.46, Period 27.46 years. A comet observed by Toscanelli and in China, early in 1457, is probably the same comet; it must have been brighter in those days, as it was easily visible to the naked eye. There would be thirteen revolutions between 1457 and 1818, average duration 27.77 years; four revolutions between 1818 and 1928, average duration 27.69 years. The action of Jupiter and Saturn causes considerable alteration in the period, as in the case of Halley's comet, whose period ranges from 74½ to 79½ years. The comet appears to belong to the same family as that of Tempel, associated with the November meteors, whose period is 33¼ years.

The discoverer of the comet, Mr. A. F. I. Forbes, is an architect by profession, residing at Rosebank, Cape Town; he himself constructed the 8-inch reflecting telescope with which he made the discovery. He had been patiently sweeping for comets for several months, so his success was well deserved. Calculation shows that the comet was far north of the equator in October, and only half as far from the earth as it was when discovered. This is an illustration of the fact that there are few, if any, comet searchers in the northern hemisphere, so that this is a most hopeful field for amateur observers to turn to.

A closely allied field, and one that can be pursued without instruments, is the observation of meteors. Even if one does not go in systematically for the work, a bright meteor may appear at any moment, and observers should know what are the points that it is most important to note. The Editor of *Discovery* has forwarded a letter to me from Mr. D. A. Davies, who reports that he saw a meteor on 6th December at 11.48 p.m. Starting a few degrees north-west of Jupiter it traversed a path from north to south-west, the length of which was about equal to the width of Orion; travelling very rapidly it burst into coloured fragments and vanished. This is a much better report than many that I have seen, but it is not quite exact enough to be of use for fixing the radiant point; observers should try to determine two points on the track within a degree or less if possible, by reference to the neighbouring stars; if one is not familiar with these one should note their aspect carefully, and afterwards identify them on a star-map. The duration is best estimated by counting or repeating rhymes at a fixed rate, which can be done with practice. The brightness should be compared with the stars visible at the time; if it is brighter than these, one can only estimate it roughly, *e.g.*, "as bright as Venus at her brightest." Some meteors leave a trail that is visible for some minutes; in such cases it is interesting to note the movement of the trail, giving its position among the stars at different times; such observations give a clue to currents in the upper air. The time of any observation must be noted accurately; at least to the nearest minute.

Changes on Mars.

Dr. W. H. Steavenson notes that there have been some interesting changes on Mars. In particular an oblique dusky stripe to the south of *Pandorae Fretum*, that was shown on drawings of many years ago, but not on more recent ones, has now reappeared. There have also been changes on *Lacus Solis*, which seems to have altered the direction of its major axis. Most people regard the dusky regions as due to some form of vegetation, so that this would appear not to behave in quite the same manner every Martian year. It was long ago noted that the polar caps did not always melt at the same rate, and M. E. M. Antoniadi deduced that the melting is most rapid when sunspots are numerous.

The Future of the Franklin Institute.

By Howard McClenahan, E.E., M.S., LL.D.
Secretary of the Institute.

Important plans proposed for the future of the Franklin Institute of Philadelphia—the American equivalent of the Royal Institution of Great Britain—were outlined to members by the author in a recent address, here reproduced by special permission. Dr. McClenahan officially visited European museums during the past summer and makes some interesting comparisons.

THE last few years have been years of vigorous life and activity in the Institute, and have witnessed growth and development which promise much for greater usefulness of the Institute to the city, and for enhanced reputation for this old society. The officers of the Institute have, however, been so much occupied with plans for the future that they have had little time and energy to tell about them. In preparing the programme of meetings and lectures for the year, the Secretary felt that the lecture season could not be inaugurated better than by a comprehensive report concerning the state of the Institute—past, present and future.

Science and Industry.

As regards the origin and purposes of the Franklin Institute, in 1823 and 1824, so the records tell us, two young men—W. H. Keating, subsequently Professor of Chemistry in the University of Pennsylvania, and Samuel Vaughan Merrick, later the first President of the Pennsylvania Railroad, were desirous of learning something of the applications of fundamental science in business and industry. They applied for membership in a society then existing and in which they believed they could readily learn what they wished to know. To their great indignation, probably to their surprise, they were refused admission. Then they did a sensible thing—they took counsel together and thought over the whole situation. They were young men of high standing, they were of the socially elect. Said they, "if we cannot find the opportunity to learn what we wish to know, what chance has the poor boy who has no friends? We will organize a society open to all men and women of intelligence, character and ambition who are interested in science."

This was the inception of The Franklin Institute. It was organized as a democracy in science whose purpose was "the promotion of the mechanic arts." It has remained true to that purpose to this day. With one exception, the activities assigned by the Founders are carried on to-day with vigour. They started a library in the physical sciences and, after a few years, began to collect patent literature. To-day our library is the best library in the physical sciences in or about Philadelphia, and possesses the only great collection of patent literature to be found between New York and Washington. We are the official depository for the governments of the United States of America and Great Britain, and have their complete files, and have much patent literature from other foreign governments.

"The Fathers" started a journal for dissemination of scientific knowledge. That Journal of The Franklin Institute has appeared twelve times a year without interruption from 1825 to the present time. I know of no journal or magazine of its type which has anything like a comparable record of age and continuity. Our Journal has become an outstanding journal of physical science. Thanks to the publications of scientific papers from our research laboratories, the laboratories of the Bartol Research Foundation, the Journal will not fail to deserve an increasingly high reputation.

From the outset the authorities of the Institute have arranged for lectures before members and friends by the leading men of the world in their several fields of study. Much stimulation and much encouragement have resulted for the scientific workers of the city. Many of the scientific marvels of the world have been first publicly described in the Hall of the Institute.

Aid to Inventors.

During all of its history, the Institute has been greatly interested in inventions and has desired to encourage and to aid inventors. For the accomplishment of these purposes, the Institute now has eight medals which are awarded for discovery or invention in different fields only after careful investigation by committees of experts appointed from a group of sixty men who constitute our Committee on Science and the Arts. All of the medals which are awarded during the Institute year are now presented to their recipients on the last meeting day of the year in May, which is known as Medal Day. It seems to have become one of the interesting scientific events of Philadelphia.

One other activity which was started almost at the inauguration of the new society has been discontinued after ninety-nine years. Schools were conducted in the Institute in various branches of pure and applied science, physics, chemistry, mathematics, machine design, engineering drawing, architecture. Many of the leaders of Philadelphia life had their training in the schools held within these walls. The great Central High School of Philadelphia had its inception here and, for years, was known as the Franklin Institute High School. But other institutions, of which Philadelphia is properly proud, came in and carried on the work admirably and sufficiently, so that The Franklin Institute could devote itself and its limited funds to work which others were not doing at all. The schools of the Institute were discontinued, wisely, I am sure, yet with regret, I feel equally sure.

We have not been content to carry on *only* along the old lines. We desire to open new roads to learning for our members and for the citizens of Philadelphia, especially for the children in the schools of the city. A set of Christmas week lectures for young people, similar to those which were first delivered by the great Faraday in the Royal Institution of Great Britain nearly a century ago, was inaugurated in 1926. And we have opened a new agency for the advancement of human knowledge and have created a great tool to aid in man's conquest and domination of Nature—the laboratories of the Bartol Research Foundation.

In 1918 Mr. Henry W. Bartol, a leader of industry in Philadelphia, bequeathed to The Franklin Institute his residual estate for the establishment and operation of a laboratory for research in the physical sciences and for the study and solution of problems of a scientific character. After occupying temporary uncongenial quarters this centre of research is soon to be removed to Swarthmore College.

The New Museum.

Members will have seen in the daily papers during the past fifteen months frequent reference to the scientific museum of The Franklin Institute, and to an agreement between that Institute and the Benjamin Franklin Memorial, Inc., sponsored by The Poor Richard Club, by which such a great museum as is dreamed of, is to be made a possibility.

The ambition of the Benjamin Franklin Memorial, Inc., and of its parent organization, The Poor Richard Club, is solely to build what they regard as a proper memorial to Benjamin Franklin. Recognizing, however, as clearly as any one, that Franklin would be the first to object to any memorial which was only ornamental, they have combined with The Franklin Institute to erect a great structure which shall not only be a beautiful architectural memorial to Franklin, but shall also house a great new educational institution which shall carry on the work in which Benjamin Franklin was an epoch-making leader, and shall vitalize the teaching of physical science in this community. They are to co-operate in bringing about the erection and equipment of a great, beautifying structure in a central section of the city, preferably on the Parkway, which shall include a monumental architectural memorial to Benjamin Franklin, a collection portraying the graphic arts as they were when Franklin was an active printer in the Quaker City, and showing also their development to the present time, a great scientific and technological museum which shall rival the scientific museums of Europe, and the auditorium, library, offices and other rooms demanded by the activities of The Franklin Institute.

Vast Endowments.

The Benjamin Franklin Memorial, Inc., agrees to try to raise sufficient money, about four to four and a half million dollars, to erect the initial structure and to aid in its equipment. The Institute agrees to make available for endowment purposes that part of its fixed endowment which can be properly allocated to this project. That sum is now determined to be two millions, six hundred thousand dollars.

The purpose and the work of the Institute have always been, perhaps, the most effective exemplification of the scientific principles of Franklin in that they have made a knowledge of science available to all men without regard to caste or state. In its new and enlarged sphere, the Institute will have as its fixed purpose to administer the Museum and Memorial so as to make it a worthy tribute to Franklin, a scientific shrine to which men will come for inspiration and learning, a noble addition to the architectural beauty of the city Franklin loved, and a lasting source of satisfaction to those who have laboured for its accomplishment.

In order to show the importance of the museum to a city of two million people, it may be pointed out that there has come about a great change, a happy change, in our conception of the purpose and the character of a museum. Not so long since, a museum was merely a depository for the collections of a man with an acquisitive sense. All too often it was only a junk heap, without much of designed arrangement, a more or less great collection of " firsts " in the special field of interest. Only originals were

tolerated—and copies, however perfect, were taboo. And all too often, the museum connoted death and inaction and lack of stimulus. Fortunately that conception of a museum has gone by the board. It is no longer primarily a home for collections. It is regarded as a great agency for education, for training, for enlightenment—and should be a dynamic adjunct to the teaching facilities of the community. These statements should be just as true—or more nearly wholly true—of a scientific museum as of an art museum, or of a commercial museum, or an historical museum. As a fact, the accomplishments of science lend themselves with especial readiness to successful, inspiring use in such an institution as we have in mind.

The establishment which we are planning will be a place where the *principles* of science are emphasized, where the scientific fundamentals are displayed as they find application in industry, and where the growth of manufacturing and engineering processes are portrayed with the utmost possible clarity. The emphasis must always be upon the idea of development. The purpose shall be to show how the present, perhaps very complex, method has come about, what has been the scientific evolution which has taken place. In such an institution, the acquisition of detailed knowledge *and* the understanding of the whole process will of necessity go together.

Working Exhibits.

There has come about another and vital change. In the old type of museum, the object most frequently seen was the " Please do not touch " sign. That sign in the modern science museums is almost as rare as some of the exhibits. The visitor is expected, even urged, to handle, to operate, the exhibits. When, in order to prevent injury to the uninitiated, a " Do not touch " sign has to be displayed, it is accompanied by another stating that the machine or device or process will be operated by the attendant, upon request. The visitor is at liberty to repeat his observations just as often as he finds it desirable to do so. And, just as far as it is possible to do so, every exhibit is to be made active, be made " to run." The " wheels go round " in the case of a machine, the chemical reactions of the manufacturing processes are carried out, the metals are deposited in any example of electrolysis, in every case there is a display of life and reality. The combination of these two abilities, the ability to touch, to handle, the exhibits, and the ability to " make them go," is the characteristic of the modern museum and is that feature which insures their greatest usefulness.

In the institutions of the older type, the aim was always to get originals. This fact was inherent in the very nature of the institution. Now it is true that the possession of at least a few pieces of apparatus with which some fundamental discoveries were made lends a tang, an atmosphere that is unique.

Examples in Europe.

For example, no electrical engineer, or physicist, can fail to have a thrill when he stands in the Deutsches Museum in Munich, before the apparatus with which Heinrich Hertz laid the foundation for the development of wireless communications. What must be the feeling of a textile man when he is in the presence of the original Jacquard loom in La Conservatoire des Arts et Metiers of Paris? And how must a member of The Franklin Institute thrill when he can touch the original electrical machine of Franklin, or the coils with which Faraday made his immortal discovery?

The purpose of this new institution being the portrayal and elucidation of scientific principles, use will be made of every recognized agency for successful teaching. Sometimes a chart—as for example, in a portrayal of an electric circuit—will be sufficient. At times a photograph may serve well, or a movie film may be required to show all the steps. Models made to scale, sectioned to show the internal structure, are enormously helpful. Models, on an enlarged scale of separate parts, or individual portions of the whole chain of steps, often facilitate understanding. Diagrams, copies, photographs, original apparatus, whatever is best suited for the particular purpose and is available, will be used in the effort to make scientific principles vividly clear. That this purpose can be carried out with success is shown in the great scientific museums of Europe, and especially of Munich and Vienna. The success attained in their purpose by these museums, and the enjoyment experienced by the visitors to them, show how greatly worth while such institutions can be.

Philadelphia was the centre of the chemical industries a century ago, and has remained so to this day in certain lines of production. Models of factories or furnaces or plants, made to scale, will show how sulphuric acid or zinc oxide or lead storage batteries or any one of many other substances are made commercially. And every effort and every suitable device will be used to make readily understandable all the scientific principles applied in these processes.

Consider engineering and industry. Pennsylvania and New Jersey are the birthplace of American railroads, and Philadelphia has been for decades the

place of production of thousands of locomotives which have traversed all the "rails" of the world. This city has been the starting point for countless trolley cars which have extended urban and inter-urban transportation over the whole of this country. And hundreds of ships for commerce, for pleasure, for peace, for war, which have riven the waters of the "Seven Seas" and of all other seas, made their initial plunge into salt water from the banks of the Delaware.

History of Transport.

These facts, coupled with the historical incident that one of the founders of The Franklin Institute was the first president of Pennsylvania Railroad, make it most appropriate that we should devote full attention to the history of transportation and to the portrayal of the expansions of science which have made modern transportation a possibility.

We shall portray the changing methods of travel from riding on the horse's back to the unforgettable voyage of the "Lone Eagle" in the *Spirit of St. Louis*, from the arduous journeys of the American Indian in his birch-bark or his "dug-out" to the luxurious and safe crossings of the *Leviathan*, from the miseries of the "bone-racker" bicycle to the comfort of the Lincoln car. And our constant purpose must be to show the logical evolution which has led from one vehicle to the next, from one method of transport to the next, and the fundamental discoveries which find their applications in the useful service of man. The exhibit devoted to transportation is one of the largest and most interesting in every museum because, probably, improved transportation has always been the goal which men constantly seek, and because of the fundamental importance of the subject.

Of course, one of the world's great engineering accomplishments is the Panama Canal. Problems which seemed insoluble were met and solved, new methods were planned, new tools were made and successfully used. Engineering feats on an unprecedented scale seem almost commonplaces in the Canal Zone! Locks large enough to pass a battleship, or an ocean liner, from one canal level to a different one, have been built and are in use, problems in drainage, in sanitation, in construction have been ingeniously solved. Can the solutions of these problems be portrayed experimentally? We shall certainly try to prove that they can be—for the instruction and training of all who are interested.

Probably no more generally attractive exhibit can be prepared than that which deals with the evolution of modern boats from the savage's dug-out, "einbaum," as the Germans call it, through the craft driven by man-power or by winds and sails, down to the giant liners of to-day, or the Flettner motor ship. Some of the collections of ship models, especially that at Munich or in the Science Museum in London, are extremely interesting and attract great attention at all times. Such displays are especially impressive when, as in the Science Museum, models are constructed to the same scale, and so show the growth and development from ship to ship. Four such models of Cunard ships, four boats which were the pride of the line when they were launched, show most strikingly the increases of size and of comfort of the ships of that great transportation company during the last thirty or forty years.

Such collections should not be merely attractive to the eye. They should always be regarded as teaching some application of science to the uses of mankind. Such models can be used to illustrate the dependence of the sea-worthiness of a boat upon the shape of the hull, the distribution of the equipment, and the stowing of the cargo. Such models can be made to show what is meant by "Stream-line form" of the hull, and perhaps also, the dependence of the speed on such form, with unchanging power. One can readily demonstrate, experimentally, the behaviour of the Flettner motor ship and can "explain" its working. And one can show by very simple experimentation that the physical principle, or law, underlying the motion of the Flettner craft explains also various apparently unrelated actions, such as the curving of the pitched baseball, the production of the sensation of fullness of the ears when a rapidly running train goes through a closely fitting tunnel, or the behaviour of the ball in "the ball and jet." Surely here is a chance to show the unification of science!

The Graphic Arts.

A portion of our agreement with the Benjamin Franklin Memorial, Inc., calls for the establishment and maintenance of an exhibit of the graphic arts as they were at the time of Franklin's activity as a printer. We should expect to display much more, for we should want to show many things which Franklin had not even dreamed of. We shall want to show printing as it was done in Franklin's shop and as it is done to-day in great modern plants. We shall portray the processes of engraving as practiced then, and as they are utilized to-day, and also how they are facilitated by the application of electrolysis and photography. We shall demonstrate the making of paper, whether rag or wood-pulp, and book-binding, the development of printing and type-setting machines and the several auxiliaries of the present printer's art.

One of our ambitions is to show photography in such a way that a "tyro" can have some informed appreciation of it, as well as learn the actual manipulations involved. It will perhaps be possible to set forth the growth of modern photographing from the labours of Daguerre to those of Eastman, on through the moving picture, through colour photography to the colour-movie.

We hope earnestly that the examples cited will show two things: how excitingly interesting such a museum as has been planned can be, and that it should be a place where many a young person may be aided, through increased knowledge, to learn of his own abilities and tastes and, therefore, to make a wiser choice of his life's work. That the first of these results may be confidently hoped for is indicated by the effects of the great European scientific museums upon the visitors to them. It is the common thing to hear of the traveller who goes to Munich to see all the beauties of that city and goes first to the Deutsches Museum—"to get through with that"—and who then goes again and again and again, to the complete neglect of all other museums and collections. One of the three or four leading physicists of the United States said, when asked if he had gone to the Deutsches Museum and if he had enjoyed it: "I spent three full days there, and wish that I might have had three full weeks." One of the great industrialists of this country volunteered the statement, "I never go to London without making at least one visit to the Science Museum in South Kensington." We mean to give to Philadelphia an equivalent institution.

Choosing a Career.

If the museum performs the second service which is expected of it, and aids young people to make wise choices of vocation, then it will indeed be a worthy and living memorial to Benjamin Franklin. You will recall Franklin's expression of approval of his father's action in taking him to visit various industrial plants in the hope that he would be thereby aided in choosing his line of future activity. No one could value more highly than Franklin would have done an institution which would have as an important by-product of its activities, helpfulness to young people in the choice of their occupations for life.

One thing the museum will accomplish, whatever else it may, or may not, bring about. It will give to the young people of school age a realization of the vitality and importance of scientific knowledge. It will show convincingly how valuably science may be applied for man's advantage. It cannot fail to inculcate, by analogy, a belief in the value of all knowledge.

Brooks-Bright Foundation.

DURING the past five years a new movement has been developing in the United States for the promotion of better relations with Great Britain. The Brooks-Bright Foundation, as the organization responsible is called, is of special interest to readers of *Discovery*, as it works mainly through schools and universities. The name honours the memory on the one hand of David Brooks, a clergyman and soldier in the American forces at the time when the American Colonies broke away from England; being an ancestor of the present founder, Mrs. Florence Brooks-Aten of New York. On the other hand is commemorated England's "great commoner," John Bright, who was instrumental in keeping the two countries at peace during the strained diplomatic relations of the Civil War. Perhaps the chief claim of the new Foundation to serious attention is that it sets out "to avoid any taint of sentimentality and to deal only in fundamental causes that are the source of real difficulties."

The first volume* under review is the first published under an annual prize offered for the two best essays written on this subject by undergraduate students of Oxford University and of Yale University. In a valuable preface, Professor Robert McElroy echoes what he wrote in these columns a year ago, on the happily altered attitude since Washington founded a national university to discourage American students from being trained under royalist influences abroad.

Of wider interest is the second volume,† which contains the work of schoolboys chosen on a competitive basis from among thousands of essays submitted. In the belief that youth affords the most fertile field for its purpose, the Brooks-Bright Foundation is devoting most of its resources to an annual essay on a set subject which shall require individual research and reading. It is hoped that knowledge will thus be obtained in a far more effective way than by lectures or other propaganda requiring no personal effort on the part of the student. For the 1928 prize several thousand American boys competed on the following set subject: "As the white population of the United States and British Commonwealth of Nations has increased in the past century from 20,000,000 to 170,000,000, in how far will the continued growth of population and the diminishing food supply affect the future relations between these two countries, and to what extent will it affect their relations with other nations?"

The standard of the three winning essays here published on the judgment of Dr. William Faunce, President of Brown University, compares rather remarkably with that of the British schoolboy of similar age. It has all the frankness and certainty of opinion which is the special prerogative of youth.

Whatever the future holds, it cannot be seriously questioned that the English-speaking peoples must co-operate in international relations. The Brooks-Bright Foundation is extending its valuable influence in British educational circles, of which a representative Committee is already at work. The editor of *Discovery* will be pleased to send further details to any interested reader.

* *Aspects of Anglo-American Relations.* By K. C. JOHNSON, of Queen's College, Oxford, and J. M. FRANKLAND, of Yale College. Published for the Brooks-Bright Foundation, New York. (Yale University Press.)

† *Brooks-Bright Prize Essays*, 1928. (Macmillan.)

The Strangest Animal in China.

By Arthur de C. Sowerby,

Editor of the "China Journal," Shanghai.

An expedition made in search of the takin, which is related to the Rocky Mountain goat, enables Mr. Sowerby to describe this little-known animal in the "China Journal," here reprinted. Museums contain very few specimens, and they are a coveted prize for the big game hunter.

ONE of the strangest animals to be found in China is the takin (*Budorcas*), which belongs to a group of ruminants forming a sort of connecting link between the cattle and antelopes on the one hand and the sheep and goats on the other. This group of animals contains also the serows, gorals, chamois and Rocky Mountain goat, all of which are characterized by having black, shiny horns, well marked with rings towards the base, large heavy hoofs, and short or comparatively short tails. They are all excellent climbers, making their homes in the steepest and most inaccessible cliffs of high, rocky mountains. The takins, of which there are three known species, are the largest members of this group, full grown bulls of the two larger species approaching the domestic ox in size. The three species of takin are the Mishmi takin (*Budorcas taxicolor*) with its subspecies the Bhutan takin (*B.t. whytei*), the Tibetan takin (*B. thibetanus*) and the Chinese or golden takin (*B. bedfordi*). Of these the Bhutan and Mishmi takins are confined to the Assam-Burmah frontier, Bhutan and neighbouring regions, the Tibetan takin is found in the highlands of North-western Szechuan and the Tibetan border, and the Chinese takin occurs only in the Tai Pei Shan region in South Shensi. Nowhere do these animals occur at an altitude much below 8,000 to 10,000 feet, thence ranging up to 12,000 feet and more in the summer.

Colour and Form.

There is a considerable difference in colouring between the four forms, the Bhutan and Mishmi forms being dark brownish, somewhat lighter on the back than on the lower parts, the Szechuan or Tibetan form being reddish yellow in the male with dark brown legs and white in the female, and the Chinese form being of a beautiful golden cream to white in both sexes, not unlike the colour of the Polar bear, but with more golden or yellow in it. In form the takins may be said to have somewhat ox-like bodies, with heavy legs and large goat-like hoofs. The hair is crisp and inclined to be long in the northern species. The heads are large, with very deep, strongly arched muzzles, the horns rising abruptly from the forehead, bending sharply outwards to the sides and then backwards and upwards in a graceful curve, ending in sharp points. They are heavily ridged at the base and on the sides. The eyes are fairly large, set high up in the head, while the ears are small and of a characteristic shape. The tail is very short. A full grown Chinese takin bull weighs something over 600 lbs., stands five feet at the shoulder and has horns some twenty inches or more in length.

Food and Habits.

The food of the takins seems to consist chiefly of the tender leaves of the dwarf bamboo which abounds even at high altitudes in the mountains where they are found. In summer, when the snows are partially melted, they feed upon grass as well as upon the bamboo. These strange animals usually go about in herds, containing at times as many as forty individuals. Occasionally one comes across a solitary bull, which, presumably, has grown too old to maintain the ownership of a herd and has been driven out by younger, more vigorous bulls, much as amongst the wild oxen. These lone bulls are always large animals, and have the reputation of being dangerous.

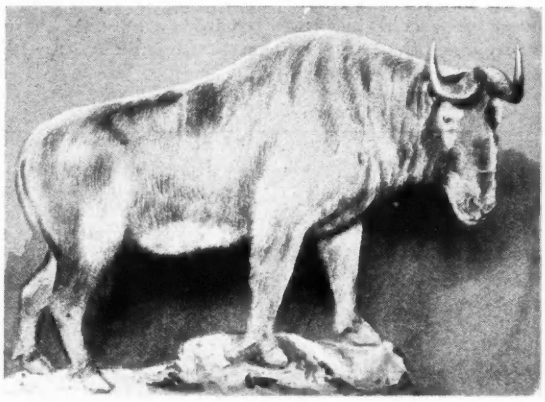
But for the fact that they live in such inaccessible and difficult country, takin hunting would be comparatively easy, for, unlike wild sheep and goats, these animals are not very keen either of sight or hearing, though there is evidence that they have a very keen scent. However, living as they do high up in the mountains, where rhododendrons and dwarf bamboo form dense, almost impenetrable jungles, it is no easy matter in the first place to discover them, and when discovered, it is often extremely difficult to get a shot at them. This, coupled with the fact that they are not common even in the restricted districts they inhabit, makes them a rare and much coveted prize for the big game hunter. Indeed, few sportsmen, even amongst those who have travelled the world over in search of game, can boast a takin head amongst their trophies.

In Rowland Ward's "Records of Big Game," not more than twenty-five specimens are listed, of which

only eight are of the two forms found in China. As a matter of fact the foreign big game hunters who have actually shot the golden takin or the Tibetan takin can almost be counted on the fingers of one hand. Certainly not more than five or six have ever shot the golden takin, and fewer still the Tibetan takin. The trouble is, of course, that these animals live in such inaccessible regions, so far off the beaten track, that few people can spare the time to go after them. And when one has taken all the trouble to overcome the long, tedious journey into the interior and has reached the outskirts of the haunts of the takin, one's troubles and difficulties have only just begun. The writer's experiences in this connexion may be described and will serve as a good example of what may be expected.

After having travelled by railway, pack mule and on foot the best part of fifteen hundred miles, worked through the lower ridges and foothills of the Tai Pei Shan range in South-western Shensi, and arrived at the base of the mighty mountains themselves, I was forced to wait day after day in a small Chinese village owing to the fact that heavy mists enshrouded the mountains, and no guide or hunter would undertake to conduct me to the hunting grounds for fear of being lost. When at last the mists cleared away and we were able to make the ascent of the mountain range, I found that even though I had engaged coolies to transport the few absolute necessities for the undertaking, I, too, would have to carry a pack if I wanted to take a camera and other further indispensables with me, for the climb was so steep and long and the snow so deep when we neared the top that the men could not carry much more than their own scant bedding and food for the party. I even had to dispense with my shot-gun and ammunition, a decision which I later greatly regretted, since it meant that I was not able to take full advantage of the wonderful opportunities offered of securing many rare birds and smaller animals for my collection.

It took two and a half days for our party to climb the northern side of the range and descend a little way down the southern side, and we had to camp the first night in a cave shelter and the second night in a woodcutter's hut at an altitude of over 10,000 feet above sea level. Here it was bitterly cold and it was all we could do to keep from freezing. On the south side of the slope, at an altitude of about 8,000 feet, we found a rock shelter where we erected rough lean-to huts out of logs and brush, and here we camped for several days while my guide, a couple of bearers and I scoured the neighbourhood for our quarry. I have never experienced such hard going or endured such fatigue, but my efforts were rewarded almost at once, for I secured a fine takin bull that was almost a record the first day and a smaller bull two days later. Thereafter all efforts to sight out quarry again failed, and, though days of heart-breaking toil were spent, and we found fresh tracks everywhere, we never caught a glimpse of another takin, and finally had to return by a hazardous route, owing to the melting of the snows in the pass by which we had entered, to our base in the foothills. As regards the takins I secured, I only had two shots, but each of them accounted for a nice trophy.



THE TAKIN.

The species here illustrated is the Mishmi takin (*B. taxicolor*), which is dark brown in colouring somewhat lighter on the back than below.

Except for an odd shot or two fired at blood pheasants, which abounded in these regions, I fired but one other shot on this trip, and that was at a yellow-throated marten which crossed our path one evening at dusk and which I bowled over with a bullet through the neck. There were evidences of wild pigs, serow, porcupine, muntjac, leopards, foxes, and even bears in this region, but I failed to set eyes on any of these animals. Indeed, except for the birds, of which the woods were full, and the little pikas or rock-hares, which were all over the place, animal life was remarkably scarce for so wild an area, but it is conceivable that our concentration on the chase of the takins caused us to miss much that might otherwise have been noted.

My guide was completely baffled over the disappearance of the takins, for he said at this time of year they should have been easy to find. It all goes to show how difficult and precarious a thing it is to get a shot at one of these peculiar animals, which accounts for their rarity in collections.

Book Reviews.

Sugar Beet in the Eastern Counties. By R. McG. Carslaw, C. Burgess and C. Ll. Rogers. (Cambridge University Press. 3s.).

One of the principal features in the agricultural position to-day is the high total cost of labour on the farm in comparison with the value of the crops it produces. This is particularly true of root crops such as mangolds and turnips, and any means whereby the areas of these can be reduced are likely to improve the farmer's economic position. Any reduction, however, must modify the farmer's stock policy; he must either reduce the number of winter stock or else feed them on a ration containing few or no roots, that is, unless the area is sown up with some similar crop. For this, sugar beet is suitable; it fulfils all the functions of the root crops in maintaining the fertility of the land and suppressing weeds; not only produces a cash crop of roots, but also provides a very considerable quantity of stock food in the form either of beet tops, or of beet pulp obtainable from the factories at preferential rates by the grower. This crop therefore fully merits the close interest that is being taken in its successful establishment in this country, an interest well exemplified in the recent Cambridge investigation under review. This is a most careful and thorough piece of economic research, carried out by modern statistical methods and making conservative estimates of any quantities that cannot be directly measured.

Whether the sugar beet crop will persist after the complete removal of the subsidy in 1931 is the most important question concerning the crop. The authors refrain from any prophecy but they show that the profits for 1927 were sufficiently slender to be readily turned into a loss. 1927 was, however, a particularly unfavourable year for the beet crop. Moreover, even if the crop ceased to be profitable, it might still continue to be less unprofitable than other root crops, though it is unlikely to be a strong competitor of successfully grown cash root crops like potatoes.

Much interesting information is to be found in this report, from the first sentences of the Foreword which show how the history of the establishment of the sugar beet crop in France, out of necessity during the Napoleonic Wars, is being repeated in this country at present, to the last sentences of the last section which give us some idea of the profits made by the factories in 1927. These lead one to the hope that the farmer will not suffer unduly on the removal of the subsidy.

One would expect sugar beet normally to occupy the root break in a rotation, but in 1927, in the Eastern Counties, it occupied several positions, due no doubt, to farmers desiring to make the most of it during the last season of the full subsidy. Such diversity of practice is typical of the whole treatment of the crop at present. On the whole it has been found better to grow the crop in large area units than in small, to apply a dressing of dung, and to subsoil. The rate of seeding which has done best has been about 15 lbs. per acre, but the farmer has taken little interest in the variety of this seed. This is scarcely surprising when the factory supplies it without giving the farmer any say in the matter, particularly when the seed has so obviously foreign a name as is usual. It seems unlikely to be long, however, before this country is producing home grown seed better suited to local conditions than foreign seed.

This diversity of practice extends also to methods of sowing, on which collected and analysed data are given in the report. The dates of sowing and lifting are very important, the former because of its effect on the yield per acre, the latter because of its effect on the sugar content, and also on the weight of soil lifted with the crop. The effect of summer cultivations on root crops has not been settled beyond dispute. The writers say nothing about this, although figures are available, for those interested, amongst the comprehensive mass of data presented in appendices.

A further report is to be issued on the 1928 crop. It will now be awaited with an interest enhanced by the circumstances that 1928 was a more successful root year than 1927, and also that it will be the first with reduced factory prices, as a result of the reduction in the subsidy for this crop.

Rothamsted Experimental Station. H. G. Miller.

The New Universities: An External Examination. By H. G. G. Herklots. (Ernest Benn. 6s.).

(Reviewed by Professor A. Smithells, F.R.S.)

It is very difficult to write a suitable notice of this book. Inside the jacket it is declared by the publisher's trumpeter that "the greatest educational revolution of modern times is in this little book criticised exhaustively and with insight." The author himself says: "It is written from a personal point of view, that of one who has recently been an undergraduate member of the University of Cambridge [*i.e.*, a Cambridge student] and who combines a very considerable [*i.e.*, overwhelming] admiration for his Alma Mater with a very sincere distress that so great a gulf has been fixed between the older and newer universities of this country." Very, very sad! ("This country," of course, excludes Scotland.) The book arose incidentally out of the labours of a Commission of the National Union of Students, but is not their report. It is called "an external examination."

As one who lived many years in and for a modern university, and one whose happiness there came so largely from companionship with students, I naturally took up Mr. Herklot's book with interest and sympathy. I wish it were possible to say that I liked it or learned something useful from it. Certainly the author has enumerated a great many of the difficulties against which the newer universities have had to contend—and are strenuously contending; he has described many of their imperfections and some of their virtues. He seems indeed ready, like some panel doctors, to range over the whole field of educational pathology, to diagnose and prescribe instantly for what he conceives to be the ills of our modern universities.

It seems to me to be a great pity that anyone of such little experience should have taken upon himself to pass judgment, in the way he attempts, upon so very large and complex a national problem. It is a still greater pity that his judgment should be presented so seriously to the public. It strikes me, if I may say so, not only as audacious but as not in the best of taste. There is an air in the book that, as I read it, reminded me continually of the accession to the teaching body at Leeds of a man from Oxbridge who had been told by a counsellor there that it would be quite a good thing "to go and rough it for a year or two at a modern university." It is really mischievous to say that a great gulf has been fixed between the ancient and modern universities. A moderate knowledge of our universities would surely prevent anyone from saying such a thing. Of course, Mr. Herklot is unable to gauge the progress that the universities have made since their start. It would be unreasonable to expect that and much else that detracts from the merit of his commentary.

I have tried hard to conceive some good issue. The book will perhaps stir up a little the students of the modern universities. I hope it will, though in every such university that I know there are always some students and certainly many teachers striking, more strongly than Mr. Herklots, the strings on which he lays his fingers in this dirge, and it is well-known in the modern universities how they appear to the young men from Oxford and Cambridge. What I am afraid of is that the book will do disservice to the cause which, I do not doubt, the author has at heart. It is not considerate enough to the cohort of splendid citizens who have given themselves to developing the modern universities, and have been animated by ideals just as lofty as those of the men and women who founded our most venerable educational institutions. The greatest difficulty that the newer universities have had to face has been the rooted belief that they cannot become—are not even on the road to becoming—what Oxford and Cambridge have been for so long for the flower of English youth. What that is I need not try to say, but if I am asked whether I believe that there is no "fixed gulf" between ancient and modern, I would reply, in Yorkshire terms, "I don't *believe*—I *know*." To that I will only add an expression of regret if I have taken my task rather too seriously.

Noah's Cargo: *Some Curious Chapters of Natural History*. By GEORGE JENNISON, M.A., F.Z.S. (A. & C. Black. 10*s*. 6*d*.).

Mr. Jennison gives us a series of essays containing miscellaneous information, culled from a variety of sources, on animals in ancient art and history, together with notes on menageries and zoological collections ancient and modern. The illustrations are interesting, being mostly from old paintings, prints, and manuscripts, depicting hunting scenes and legendary beasts; interspersed with these are modern photographs of animals often set by the side of the old figures for comparison. The best part of the book is in those passages dealing with the living animals and their habits. The author, who was for years head of the well-known Belle Vue Zoological Gardens in Manchester, has had much experience in these matters, and his notes are both amusing and instructive.

Naturally, the apes and monkeys are the most intelligent of all the animals, but the bear apparently comes in a good second. We read that few animals are as clever as the bear, who learns so many tricks untaught, plays so well, and is so easy to train. It has a sense of humour too, appreciates soft, sweet music, dislikes discords, and is quick at picking up the rhythm of a dance. The bears, we are told, are more intelligent than the cats, and the most difficult work in an animal show is usually allotted to them, although they are probably the most dangerous beasts to train. The polar bears are the least clever of the group. Among the monkeys the ring-tailed Capuchin or Cebus is equal to the chimpanzee in thinking out ways and means of reaching out for distant nuts with sticks of various lengths, and it was in the Belle Vue Zoo that, to the amazement of everyone, a female chimpanzee made a nest in August, 1914, the only known instance in England. This nest was constructed of small branches and twigs, taken from a heap thrown on the floor of the cage; it was made on a beam to which were nailed three branches. In two days she had a round nest with the leaves in the centre carefully trodden down. She sat here, always holding a rope, presumably as a quick means of escape. About once a week she threw down the old nest and made a new one.

There are chapters on elephants, camels, lions, tigers, parrots, and many other animals all of which have their fair share of consideration. The stories and anecdotes about all of them make the whole volume readable and amusing.

MARIE V. LEBOUR.

Astronomy and Cosmogony. By SIR J. H. JEANS, F.R.S. (Cambridge University Press. 31*s*. 6*d*.).

It is eleven years since the author of this important work brought out "Problems of Cosmogony and Stellar Dynamics," an essay which gained the Adams Prize at Cambridge; the present volume is supplementary to it, and repeats the study of the figures of equilibrium of rotating liquid and gaseous masses. But the great advance in astronomical knowledge in the interval necessitated the preparation of this larger book, which deals in a comprehensive manner with all the leading problems suggested by study of the stellar and nebular systems. Of necessity a considerable portion of the work is taken up with mathematical reasoning, but the larger part is descriptive and easily intelligible to non-mathematicians. It is beautifully illustrated with photographic plates of star-clusters and nebulae, taken at the great American observatories; some of these are reproduced for the first time.

The reader is introduced to the Cepheid-luminosity-law, which plays such an important part in the estimation of the larger astronomical distances; the law asserts that the actual amount of light given out by a variable star of the type of Delta Cephei can be determined by the period in which its light varies, and that consequently we can determine the star's distance by observing its luminosity and the time of its light-change. The author, while accepting the law, differs from most astronomers in his explanation of it. The usual interpretation is that these stars are alternately dilating and contracting, like a bladder that is first blown out and then allowed to collapse; he supposes that the star's core, but not its outer surface, has split in two, and that the revolution of the two parts about each other produces a huge fiery wave travelling round the outer surface.

The book contains a full discussion of the source of stellar energy. The author concludes that the only source that will explain the enormous output of the stars through the very long periods during which they continue to shine, is the annihilation of matter and its conversion into radiant energy. About the beginning of the century the discovery of the radio-active elements opened men's minds to the great store of energy locked up in the atom; the author was one of the first to see in this stored energy a way out of the deadlock that had existed ever since Lord Kelvin had showed that the gravitational theory of the sun's heat would only give it twenty million years of shining in the past, a period quite too short for the geologists, who demanded at least a thousand million years for the past history of the earth; good reasons are given in the book for estimating the duration of the existence of the stars in the past not by thousands of millions but by millions of millions of years; one of these reasons is based on the study of the orbits of double stars; these are supposed to have arisen from the splitting of a star into two portions through rapid rotation, but this would not explain their recession from each other to such great distances as we find in the orbits of many binary stars; the author explains this recession by the perturbations arising from the near approach of another star. But these near approaches are so rare that we need a very long interval of time for a sufficient number of them to occur. It will be remembered that the near approach of a star to the sun is the explanation most in vogue for explaining the outpouring of

matter from the sun from which the planets are supposed to have been formed. This subject is also discussed in the book.

Dr. Hubble's brilliant work on the spiral nebulae is fully treated. He has shown that they are external universes, the nearest of them about a million light-years away, while the furthest that can be reached with our largest instruments are a hundred times more remote. But it is not sufficiently emphasized by the author that a similar conclusion was reached by Sir William Herschel more than a century ago; the following passage from a lecture delivered by O. M. Mitchell eighty-five years ago ("The Orbs of Heaven," p. 191) has been familiar to me since my boyhood. "Go out on a clear cold night and count the stars which strew the heavens; for every orb thus visible to the naked eye the telescope reveals a *universe*, far sunk in the depths of space, and scattered with vast profusion over the entire surface of the heavens. Some of these blaze with countless stars, while others, occupying the confines of visible space, but dimly stain the blue of the sky, just perceptible with the most powerful means that man can summon to the aid of his vision."

The book can be heartily recommended to all who wish to gain a clear and accurate knowledge of current thought on sidereal astronomy, and who are not afraid of a little hard thinking. There are a considerable number of astronomers who differ from the author on some of his conclusions; but even these will welcome a full statement of his reasoning, since this facilitates the marshalling of the arguments on the other side.

A. C. D. CROMMELIN.

Problems of Instinct and Intelligence. By Major R. W. G. Hingston, M.C. (Edward Arnold & Co. 10*s.* 6*d.*).

In this book of nineteen chapters the author has discussed instinct and intelligence and, like many before him, has confused them in the process. He enlarges on the perfection of instinct in Chapter II and he devotes Chapter IX to its errors. He deals with its inflexibility in Chapter III and in Chapter VIII he discusses its variability. Three times he mentions that Fabre's view was that instincts are invariable (pp. 99, 117, 132) and, immediately following the last reference, he says: "In one very remarkable chapter he (Fabre) writes as if driven almost to contradiction. He admits a kind of rudimentary faculty, yet he fights against the word *Intelligence*. What does he do? He invents a term. He grants the insect what he calls *Discernment*."

As a fact Fabre many times gave examples of individual memory in insects and showed, *e.g.* in *Sphex flavipennis*, that some individuals learn quickly while others are stupid. He showed, moreover, in the case of the wasp mentioned, that the memory was inherited by the next generation. Many authors besides Fabre have shown that insects can learn by experience, but they do not all describe this as variability of instinct.

Our author uses examples of adaptability in his chapter on the Variability of Instincts, and again we find similar examples in the chapter on Rudiments of Intelligence. If instincts are variable, as he suggests, I cannot see the difference between variable instincts and rudimentary intelligence. But the whole field seems to have been explored by Bouvier in "The Psychic Life of Insects" which was translated into English by Dr. L. O. Howard in 1922. Bouvier distinguished Race memory and Individual memory and pointed out that in the former the vague original psychism has been transformed into a pure automatism while "individual memory also has led to habits which have quickly turned to automatism." Thus it seems that instincts in their elementary condition are little more than race memory, perhaps built upon a minimum of individual memory, whereas the "intelligence" which is discussed in Chapters XI to XV is instincts which have been elaborated by a high degree of individual memory inherited from generation to generation plus individual memory in the generation actually observed.

I cannot but feel that justice has not been done to Fabre, reference to whose work has been omitted in several places and credit given to subsequent workers who merely repeated experiments carried out by that wonderful naturalist.

FRANK BALFOUR BROWNE.

Life and Work of Sir Norman Lockyer. By T. M. and W. L. LOCKYER, assisted by PROFESSOR H. DINGLE and other contributors. (Macmillan & Co. 18*s.*).

The general bibliography contained in this volume is followed by an account of Lockyer's contributions to the various branches of knowledge. Few men have given such "revolutionary" contributions to such branches as Lockyer was enabled to do during the course of an amazingly full and active life, much of which was spent in the ordinary humdrum of War Office routine or in his sphere as Secretary of the Duke of Devonshire's Commission on Scientific Education.

Lockyer was enabled in his boyhood to gain knowledge on many aspects of natural phenomena since his father, Secretary of the Rugby Literary and Scientific Institution, took a keen interest in science as a hobby. When twenty-two years old he entered the service of the War Office, where he continued to hold an appointment for seventeen years until the completion of the work of the Duke of Devonshire's Commission in 1875. He was then transferred to the Science and Art Department to organize the Loan Exhibition of Physical Apparatus of 1876. He was later put in charge of the observational and experimental work undertaken by the "Solar Physics Committee." One of the great aims for which he worked was the establishment of a National Solar Physics Laboratory—and the spirit which guided his remarkable energy is seen in the continuance of his work at Salcombe Regis Observatory, erected by private generosity, after the work of the Solar Physics Committee was transferred to the jurisdiction of Cambridge University.

His first literary work was undertaken in connexion with the scientific editorship of *The Reader*, a weekly "Review of Literature, Science and Art" which continued publication for two and a half years after its first production in 1863. Further research led in 1868 to his spectroscopic observation of the sun's corona—a work the credit for which he shared with M. Janssen who had first observed them during an eclipse. His work now brought him the coveted honour of election to membership of the Royal Society, and in the same year he became editor of *Nature*, which for thirty years did not pay its way, but which under fifty years of his editorship gradually attained its present respected position.

Lockyer was a man who was always ahead of his time. Many of his deductions from his astronomical observations brought him into violent controversy with the current opinion. The opposition in no way deterred him from pursuing the path he had elected to follow, even though it meant comparative isolation. His views on education were also much in advance of his day; and as long ago as 1904 he headed a deputation to the Prime Minister and Chancellor of the Exchequer to urge the State endowment of universities.

Gorilla: *Tracking and Capturing the Ape-man of Africa.* By BEN BURBRIDGE. (Harrap. 10*s.* 6*d.*).

Shikar: *Being Tales told by a Sportsman in India.* By LIEUT.-COLONEL C. H. STOCKLEY, D.S.O., O.B.E., M.C. (Constable. 12*s.*).

The experiences of men on hunting or shooting expeditions are invariably of interest; and these two books are no exception to the general rule. In his expeditions through the areas bordering on Lake Kivu in Central Africa, where the gorilla abounds in the dense tropical forest of mountainous tracts, the author of the first volume has stalked many species of wild game with both camera and rifle. The earlier chapters of the book describe his encounters with elephant, buffalo, rhinoceros, lion and other big game; but of main interest is the account of the two Central African expeditions which he undertook with the object of capturing gorillas.

To those who have witnessed the film account of hand-to-hand encounters with young gorillas, in successful attempts to capture them alive, this written version will be of especial interest. The author is, we believe, the only man who has devoted such a long period of time to observation of these anthropoids in their dense forest home, where travelling in the damp forest undergrowth adds many discomforts to the usual hardships attendant upon travellers in tropical regions. Quite apart from the value of the photographic records, obtained at great risk, his observations fill a gap in our knowledge of this most interesting, though ferocious, simian relation of the human species.

"Shikar" contains accounts of many hard-gained triumphs of the hunter in the wild mountain districts of India. The separate episodes in the book are well told and the illustrations are good.

Adventures of an African Slaver. Being a True Account of CAPTAIN THEODORE CANOT, Trader in Gold, Ivory, and Slaves on the Coast of Guinea: His Own Story as told in the Year 1854 to Brantz Mayer. (Routledge. 15*s.*).

Why go to fiction for adventure when you can get fact, however post-prandially adorned? Over a bottle of port and a box of Havanas, Captain Canot became the ideal *raconteur*, and we owe nothing but gratitude to Herr Mayer for using his opportunities so well. For here is a really jolly book, in spite of the sordid subject with which it deals.

Actually French by birth, Canot was in character an Italian *condittiero*, born out of due time. Suave, politic, and unforgiving, he might have been someone in any period of history. In the new slave trade which developed after the Napoleonic wars, he rose to a position of much importance, and slavery, he would have us believe, was not always carried on under such terrible conditions to the victims as we have been led to think. In his own account of the famous "middle passage" in his book, he speaks of plentiful food, strict cleanliness, and pains taken to secure good ventilation. Why not? Since the better the condition in which his cargo arrived, the better the price which could be got. Yet even in this narrative he cannot deny us a picture of the reverse conditions which we usually conceive.

The truth was, cruel or merciful the venture had to be made to pay, and the profits could be enormous. "At the appointed day, *La Fortuna* (his first ship) sailed with 220 human beings packed in her hold. Three months afterwards I received advice that she safely landed 217 in the bay of Matanzas, and that their sale yielded a clear profit on the voyage of forty one thousand four hundred and thirty eight dollars," and lest he may not be believed, a complete account is subjoined. But as with most other traders, it was a case of "quickly comes, quickly goes," and 1853, after thirty years of adventure, found Don Theodor lounging about the wharves of Baltimore cadging for drinks, a perfect wreck, and a ready victim to Herr Mayer's pen. If this were all, it would be, perhaps, hard to see where the "jollity" comes in. But Canot was "a rolling stone" and an opportunist with a sense of humour; his amanuensis, a man with a real gift for narrative, however turgid, ungrammatical and euphuistic his style. There is an account of a "Royal Marriage" in these pages, where a negro princess, destined for Canot by the king owing to his importance among the natives, is palmed off by the latter on his more complacent companion Joseph, which makes as good reading of its kind as anything which may be found anywhere, and for which Mr. Cowley and his publishers deserve equal thanks.

The Mond Nickel Bulletin. Monthly. (Issued gratis by the Mond Nickel Company Ltd., London.)

Intensity of research and rapidity of technical development are so pronounced to-day that it is extremely difficult to keep in touch with the advances as they are made. So vast is the technical literature that the time involved in mere perusal is enormous, and in consequence there is an increasing tendency towards the use of abstracts. Although this practice by no means absolves the reader from careful reference to relevant originals, it serves a useful purpose in providing, as it were, "sign-posts." In the application of science to industry it is inevitable that many important firms are finding it necessary to prepare special abstracts for the use of their staffs. Other organizations, again, go a step further and are willing to share this information with their clients or even with industry as a whole. In this latter category are the Mond Nickel Company, whose recently founded monthly *Bulletin* is now supplied on demand to anyone interested in the uses of nickel or its many alloys. This publication sets an excellent example of technical service which should be valued by all who are concerned with the theory and practice of metals in industry.

Oraon Religion and Customs. By RAI BAHADUR SARAT CHANDRA ROY, M.A., M.L.C. (The Industry Press, Calcutta. 12 Rupees).

When the history of ethnological study in India comes to be written, the name of the author of this work is least likely to be overlooked. By his own work and by his encouragement of others as editor of the periodical *Man in India*, he has deserved well of his colleagues in anthropology. Sarat Chandra Roy has published here the promised continuation of his studies of the Oraon of which the first instalment appeared as long ago as 1915. Some of the material has appeared in scientific journals in India; but it is incorporated here with additional information gathered by subsequent research.

The Oraons belong to the Dravidian linguistic group of the peoples of India. Constantly in touch with Hindus and Hinduised groups, they show signs of borrowing as the result of that contact, but in the main their religious beliefs and culture are still at a very primitive stage. The author is here concerned only with their religious and magical beliefs, both directly in themselves and in their relation to the Oraon social institutions, such as are involved in birth, marriage, and death. Of particular

interest to students of folklore and primitive religion are the sections dealing with agricultural ceremonies and the belief in witchcraft which afford much useful material for both comparison and contrast with European folklore.

A final chapter deals with revival movements and modern tendencies in Oraon religion which is highly suggestive and deserves the careful attention of all who are in any way interested in or connected with the problems of administration among peoples of non-European culture.

The Lunar Calendar. Invented by W. A. SMALLCOMBE, B.Sc., Curator of the Public Museum, Reading. (E. Gerrard & Sons. 65s.).

Recently great strides have been made in the linking up of museums and art galleries with the education authorities in our cities. It is realized that personal contact with actual material, either real or in model form, makes a lasting impression on the mind. One moment's glance at a real giraffe conveys more than an hour's talk. The " lunar calendar " under review was devised about a year ago, appropriately by the curator of a large provincial museum. It has been in constant use since, and aims at conveying to the visitor or pupil a conception of the movement of the earth and moon ; the so-called phases of the moon ; the tides ; the tilt of earth's axis for seasons; the meaning of the eclipses ; and finally a daily date calendar.

This calendar is eminently suitable for schools and lecture institutions. To make a class responsible for the setting and movements of the calendar for a month will convey a lasting conception of the wonderful events in the heavens, which all too many of us merely take for granted.

Discoveries and Adventures in Central America. By THOMAS GANN, F.R.G.S., F.R.H.I., M.R.C.S. (Duckworth 21s.).

Dr. Gann's account of his explorations and excavations in Honduras during the season 1927-28 is concerned mainly with the work of the British Museum Expedition to Chumucha. The principal result of the season's work was the discovery of a remarkable series of stelae. Fragments of twenty in all were found, and these have yielded dates in the Maya numeration which correspond in the Christian system to a period ranging from 1st February, A.D. 314, to 22nd October, A.D. 471. From the historical point of view, this was by far the most important result of the expedition ; but of almost equal interest from the point of view of our knowledge of Maya culture, was a remarkable profusion of polychrome pottery showing figures of men and animals, hieroglyphs, and geometrical design. Chumucha would seem to have been the centre of manufacture for this type of painted ware. In its keen observation of ways of the native and of the wild life of the forest, this book in no way falls short of the standard of Dr. Gann's preceding volumes.

British Floods and Droughts. By C. E. P. BROOKS, D.Sc., and J. GLASSPOOLE. (Benn. 10s. 6d.).

The use of wireless has made the familiar weather forecast an accurate general statement of future conditions. Another result has been a better understanding of the causes of exceptional climatic conditions in any area, which has enabled the student to appreciate former meteorological conditions as well as to foretell those of the immediate future.

An " old-fashioned winter " is an expression which draws more upon the imagination than upon fact. The authors have shown in their survey of British climate through the centuries since the Roman Era that, although there have been many fluctuations in rainfall resulting in conspicuously dry or wet periods, there has been no appreciable long-continued succession of winters very much colder than the present average. The prevalent idea that a more equable climate is our present lot is attributed to the deep impression any really serious spell of frost or snow makes upon us when we are children.

After an able introduction dealing with the general types of rainfall in the British Isles the authors deal with the causes of persistent rain and the damage done by recent rainy periods with their accompanying floods. The causes of the Thames Flood of 1928 are enumerated, and the conclusion reached that the disaster was the result of wind and tide in conjunction with the flood-waters of the river.

The second part of the book deals with droughts experienced in the British Isles, and the inference is drawn from contemporary records that the driest period in historic times was in the first half of the eighteenth century. It must be remembered, however, that accurate records have only been kept during the last fifty years, and that useful and comparatively numerous though these now are, they have often not been continuous in any one station.

Chronicles of Kenya. By A. DAVIS and H. J. ROBERTSON. (Cecil Palmer. 7s. 6d.).

Two editors of local newspapers have combined to write a series of satirical sketches of contemporary life in Kenya, to which a former Governor contributes an introduction. They deal with conditions which arise out of the relations of administration, white settlers, Indians and natives. It is well known in certain circles that things are far from well in Kenya, and these sketches, though humorous in form, are serious in intention. Notwithstanding their pardonable exaggeration, they deserve careful study. It may be hoped that they will make a wider public acquainted with certain sides of a very difficult problem of administration which has to be faced.

Motorshipping : The New Era in Sea Transport. By A. C. HARDY. (Chapman & Hall. 15s.).

In a previous volume, " Motorships," the author presented the reader with an able description of the most modern developments in internal combustion engines consequent upon their use in ships, giving him " a technical basis to the study of motorshipping." In the present volume, however, he deals with the problems which the revolution in shipping, consequent upon the introduction of the internal combustion engine, has brought about. As surely as the steamship banished the sailing ship from the seas is the Diesel-engined ship taking pre-eminent place amongst sea-going vessels. In the words of Lord Kylsant : " In no direction has rapid change and development been more marked than in that of marine engineering, and if there is one factor that has characterized ship-propulsion since the war more than any other it is the rise and widespread adoption of the motor-engined vessel."

The value of the Diesel engine in all classes of ships is compared with that of steam—and its great economy demonstrated. This conversion to Diesel-engined vessels, it is pointed out, has already altered, and will continue to alter in the future, the trend of the main shipping routes of the world in accordance with the distribution of the world's oil supplies ; so that the introduction of the Diesel engine will be seen to have far-reaching economic consequences.

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